Approved:

Ben G. Watts, P.E.
Secretary

Effective: November 4, 1991
Responsible Office: Safety Office
Topic No.: 500-000-100-c

HIGHWAY SAFETY IMPROVEMENT PROGRAM
(GUIDELINE)

PURPOSE:

The objective of this guideline is to enable FDOT Safety personnel to identify high hazard locations, develop hazard reducing safety improvement projects, and evaluate the project's effectiveness.

AUTHORITY:

Federal Highway Safety Act of 1973 and the Federal Highway Program Manual (8.2.3) revised, March 5, 1979.

GENERAL:

This guideline updates the 1990 HSIPM to current established policy.

INCORPORATION BY REFERENCE:

The Highway Safety Improvement Guideline is hereby incorporated by this procedure and made a part of the Standard Operating System of the Department. Copies of this document and any amendments thereto are available in the State Safety Office, 605 Suwannee Street, Mail Station 53, Tallahassee, Florida 32399-0450; telephone 488-3546 (Suncom 278-3546).

EXCEPTIONS:

Due to the complexity of this guideline, it has not been prepared in the established outline format of the department's Standard Operating System.

INTRODUCTION

The Highway Safety Act of 1973 marked the first time that Congress specifically designated construction funds for highway safety improvements. It was the intention of Congress that each state compile the necessary inventories and develop methodologies for identifying hazards on the highway. The types of hazards for which funding was designated were high crash locations, slippery pavements, roadside obstacles, and rail-highway grade crossings.

The Federal Highway Administration (FHWA) of the U.S. Department of Transportation is responsible for implementing the Congressional mandate. This agency developed the Federal-Aid Highway Program Manual to provide program direction.

The March 5, 1979 revision to the Federal-Aid Highway Program Manual (8.2.3) requires that the Highway Safety Improvement Programs in each state include processes for planning, implementing, and evaluating safety programs and projects. The Florida Department of Transportation, in keeping with the objectives of the Federal-Aid Highway Program Manual, has developed this Highway Safety Improvement Program Guideline.

This guideline is intended for use by district and safety engineers who are involved with Highway Safety Improvement Programs. It contains detailed information that describes how to identify hazards, develop a safety improvement project, implement the project, and evaluate the project's effectiveness from both a cost and performance standpoint. The guideline will also be useful to city and county engineers developing or implementing a highway safety program.

This document also describes processes used by FDOT for developing highway safety improvements. Perhaps more importantly, it describes how to identify a hazard by using crash reports, statistical data, or by conducting a field review. Criteria are also included for installing railroad grade crossing traffic control devices.

This guideline is intended to provide assistance to public transportation personnel in developing and implementing a highway safety program. In many instances, these guidelines impose an almost unattainable standard. A public agency's failure to comply with any specific term set out in the guideline should not be considered to be negligent conduct giving rise to liability.

The objective of this Highway Safety Improvement Program Guideline is to enable personnel to develop projects that are acceptable to FHWA and cost effective in reducing crashes. The steps necessary for developing improvement projects that are eligible for federal funding are described in the guideline.

Evaluation techniques are described that will guide engineers in improving the project development process. Changes in processes and guidelines will be included in this guideline and subsequently evaluated. As long as this cycle continues, this guideline can be a viable tool for reducing crashes.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

SECTION I

PLANNING

1.0 INTRODUCTION

Florida Statute 316.066 requires that an investigating officer forward a written report (Florida Traffic Crash Report-FTCR-Form HSMV 90003 through 90005, Appendix B) to the Department of Highway Safety and Motor Vehicles (DHSMV) if a crash results in bodily injury to, or death of any person, or the crash involves a violation of statutes 316.027(2), 316.061(1) or 316.193. Additionally, any crash which requires a wrecker to clear the wreckage shall be reported.

In every case which does not meet the circumstances described above, the law enforcement officer may, within 24 hours after completing the investigation, forward to DHSMV and provide each party involved in the crash a short-form. Each party will complete the short form as required by law. Only those crashes reported on a FTCR long form are presently processed by FDOT. However, future circumstances may warrant processing of the short-form.

Upon receipt and processing by DHSMV these reports are then forwarded to the Department of Transportation, Safety Office for processing with regard to location on the state maintained highway system and crash severity. This data is entered into the Department's electronic data base and merged with the County Roadway Information (CRI) file. These reports are also microfilmed by the Safety Office for future reference and analysis.

Some counties and cities also maintain crash records and highway inventory data for areas within their jurisdiction. The extent of crash data, location data, highway inventory data and their correlation vary with each community.

The Department correlates crash location data and highway inventory data to determine high crash locations. High crash locations are analyzed and safety improvement projects are developed using the benefit-cost method, which is discussed in more detail in paragraph 2.1.5. Safety improvement projects developed by local governments are eligible for state and federal funds, providing that the local government has a qualifying Highway Safety Improvement Program (refer to paragraph 1.5).

1.1 TRAFFIC AND ROADWAY INVENTORY

The base of the Department's electronic data records system is the County Roadway Information (CRI). The data elements are location, type of highway, physical characteristic, vehicle traffic, traffic control devices and crash history.

1.1.1 <u>Standard Roadway Characteristics</u>

All state maintained highways were surveyed and geometric data recorded in 1957. These surveys have been updated periodically. The basic identification of the highway is the county, section, subsection and milepost. Each county is identified by a two-digit number, each section by a three-digit number and each subsection by a three-digit number.

Section/subsection numbers are unique only to the county; therefore, when identifying a highway section, county-section/subsection numbers are combined. The milepost represents a point on the section/subsection and is recorded to the nearest thousandth of a mile. These geometric mileposts (field markers are not used except on interstates and turnpikes) begin at the end of another section or a county line, and progress in a northerly or easterly direction as a general rule. Some exceptions such as roadways with overall bearings of N 45° W or one-way roads and ramps may vary from this general rule. The data collected for each highway includes but not limited to the following:

a. County-Section/Subsection = Roadway Identification

b. Beginning Milepost

c. State Road Number

d. U.S. Road Number (if any)

e. Federal Highway System

f. Functional Classification

g. Rural or Urban (also incorporated areas)

h. Horizontal Curve Data

i. Intersections

j. Railroads

k. Structures

l Type of Surface

m. Surface Width (Travelway)

n. Shoulder Width

o. Shoulder Type

p. Median Width

q. Median Type

r. Parking

s. Number of Lanes

t. Speed Zone

u. Type of Road (Divided, one-way, etc.)

A segment length may be identified by changes in the above data as well as any significant change in the traffic count. An example of this inventory data (Straight Line Diagram) is displayed in Appendix A-1. The responsible organization for this inventory is the Transportation Statistics Office. This inventory data is revised by District Planning Offices within 21 calendar days of any revision to the listed descriptive data. Also a complete resurvey of all construction projects after completion utilizing the final construction plan is used to keep the inventory current.

Traffic counts of state maintained highways are obtained by the Transportation Statistics Office and the District Transportation Planning Office. The Office maintains 89 permanent automated traffic counters. These permanent stations count the number of vehicles that pass by the counter on a 24-hour per day basis, 365 days a year. Some counters also collect data on vehicle speed. Through the use of telephone lines, this data is provided to the Tallahassee data station daily. To supplement the permanent stations, approximately 7,500 24-hour traffic counts are adjusted for the week of the year by weekly factors determined by the location's historical relationship with the most appropriate permanent count stations. The responsibility for collection of the 24-hour counts lies with the district. From these traffic counts, a statistical computer program calculates the annual Average Daily Traffic (ADT) for each section and subsection of highway. The section ADT is part of County Roadway Information.

1.1.2 Structural Characteristics

In addition to the standard roadway characteristics, specialized data for structural characteristics is recorded. This additional data includes the following.

a. Bridge Number

b. Number of Piers

c. Structural Deficiencies

d. Sufficiency Rate

The Maintenance Office provides this data as well as load and safety ratings determined through periodic inspections. Other structural and geometric data is contained in the Structure Inventory and Appraisal maintained by the Structures Maintenance Section of the Maintenance Office. This inventory contains a rating of each structure's components, proposed improvements, and cost of improvements. It also contains the following key inventory elements:

IDENTIFICATION

a. City/Town

b. County

c. Feature Intersected

d. Facility Carried (Road Number)

e. Structure Number

f. Vert. Clearance

g. Longitude

h. Bypass Detour Length

i. Toll

j. Custodian

CLASSIFICATION

k. Federal-Aid System

l. Functional Class

STRUCTURAL DATA

m. Year Built

n. Lanes on Structure

o. Lanes Under

p. ADT

q. Year of ADT

r. Design Load

s. App. Rdwy. Wdth. w/Shld.

t. Bridge Median

u. Skew

v. Structure Flared

w. Traffic Safety Features

x. Navigation Control (Authority)

y. Navigation Vertical

z. Wearing Surface

aa. Nav. Horiz. Clearance

bb. Type Service

cc. Structure Type Main

dd. Structure Type App.

ee. No. of Spans Main

ff. No. of Approach Spans

gg. Total Horiz. Clearance

hh. Max. Span Length

ii. Structure Length

jj. Sidewalk

kk. Bridge Rdwy Width Curb to Curb

ll. Deck Width Out to Out

mm. Vertical Clearance Over Deck

1.1.3 Traffic Engineering Characteristics

The Districts are responsible for maintaining a traffic signal inventory in the CRI. The inventory includes the type, location, and number of traffic signals.

Some of the districts are maintaining an inventory of other information such as posted speed limits, pavement symbols, and school zones. Currently, however, the Traffic Engineering Office has no policies which require this information to be in the CRI because the maintenance of these items is not under their control.

The CRI has the current and previous 5 years crashes occurring at each milepost, recorded to one thousandth of a mile. The crash record includes crash number, date, and injury severity. This information is obtained from current year electronic data records processed by the Safety Office.

1.1.4 Skid Hazards

A separate inventory of skid tests is also maintained. This inventory uses the section milepost as the reference base. The data stored in the Skid Hazard Reporting System is as follows:

I. Test Data

- a) Skid Test ID Number
- b) Date of Skid Test
- c) Roadway ID, (County, Section, Subsection)
- d) Milepost Limits of Test
- e) State Road Number
- f) Direction(s) Tested
- g) Average Skid Number(s) (Pavement Friction Number)
- h) Surface Type
- i) Weather Condition and Temperature
- j) Unit and Operator ID
- k) Test Type (Inventory, Spot Hazard, Special, Overlay, New)
- l) Job Number
- m) Posted Speed Limit
- n) Speed at which the test was conducted

II. Physical Data

- o) Pavement Width
- p) Average Daily Traffic
- q) Year and Type of Last Improvement
- r) Pavement Condition (Rut, Ride, and Adjusted Rating)

III. Project Information

- s) Improvement Project Location Description
- t) Work Program Item Number
- u) Wearing Surface (proposed)
- v) Estimated Cost
- w) Benefit/Cost Ratio
- x) Proposed Construction Date
- y) Skid Test Disposition Code
- z) Skid Test and/or Project Status
- zz) Comment on Corrective Actions Taken

The Materials Office, is the office responsible for conducting the surface skid tests and recording the data. Items a through n, are the responsibility of the Materials Office. Items o through zz are entered by the District Safety Engineer when appropriate into the SHR Data Base.

The Department has been involved in evaluating skid characteristics of surface courses since 1958. Initial testing was conducted with a Tapley Decelerometer mounted in a passenger vehicle. In the late 60's and early 70's, the Department began to pursue methods to improve the efficiency, safety, and increase its ability to measure skid characteristics. This resulted in a decision to utilize the trailer method which is still in use (ASTM E 274).

The Current method of skid testing was started in the late 60's. As more emphasis was placed on the skid crash reduction program, it was expanded to meet these demands. The inventory program began with a random selection of sections in 1974 in accordance with IM 21-2-73, Skid Crash Reduction Program, issued by the FHWA. Since 1977, inventory testing has been maintained by a systematic testing program. In addition to the inventory program, skid tests are conducted when: 1) the District Safety Engineer initiates a request (usually based on crash data), 2) after construction or resurfacing, 3) special requests, e.g., research projects, county/city roadways, or 4) surfaces approaching the questionable range, or 5) another test is scheduled.

Skid tests are conducted with a standard two-wheel trailer towed by a vehicle (one ton pick-up) which conforms to ASTM E 274-85, "Standard Tests Method for Skid Resistance of Paved Surfaces using a Full-Scale Tire". Skid units are calibrated in-house at intervals of thirty (30) to forty-five (45) days per ASTM specifications. Annual calibration of two units and in-house calibration equipment is conducted at a Field Test Center approved by the FHWA.

Skid tests are normally conducted at 40 mph. In some situations speed gradients are obtained (40 & 60 mph) in accordance with ASTM E 274-85. Data obtained from speed gradients should be used only for the pavement surface being tested.

Skid tests are conducted in the left wheelpath of the lane tested. Normal testing procedure is to conduct no less than three (3) and no more than five (5) tests per mile or section (if less than a mile). The mean skid value is determined from the arithmetic average of the tests conducted on a section of roadway. Criteria for this is outlined in Sections 7.2 & 7.3, ASTM E274-85.

1.1.5 Rail-Highway Crossing Inventory

As part of a U.S. Department of Transportation - Association of American Railroads (USDOT-AAR) National Grade Crossing Inventory and Numbering Projects, personnel from the Department and the railroads conducted an inventory of crossings in Florida. The original survey employed the use of high-rail cars and gathered limited data and was completed in May, 1974. The data was gathered to satisfy requirements of the USDOT-AAR Procedures Manual dated September 1973. Additional data was included for the use of FDOT. At each crossing a unique seven digit identification number was assigned and at most of the crossings a metal tag with that ID was later placed. That number is to remain assigned to the crossing location regardless of the status of the crossing (open, closed, deleted, etc.). Later revisions to the USDOT-AAR Procedures Manual and additional data requirements of the Department have expanded the amount of information required by the inventory. Data elements (shown in Table 1) indicate the wide range of data that is necessary to more completely identify each crossing on its own merits. Primarily, the inventory is used as a tool in producing the Annual Safety Index (ranking list) for identifying crossings where the expenditure of safety funds might reduce safety hazards and thus save lives. The Transportation Statistics Office manages an inventory in accordance with the USDOT National Railroad Highway Crossing Inventory Update Manual so that Florida might be eligible to receive and disburse safety funds. The USDOT also maintains an inventory, which is updated from the FDOT inventory, and by changes sent to them by the railroads. The data in Table 1 is to be reviewed once every three years, both by field survey and office research for verification or revisions. Any discrepancies are changed in the data base as they are received by the Districts. A few of the items are continually changed (rail speed, functional class) while some are revised on an annual basis (school bus counts, train speed, crash, etc.). The Department's Procedure No. 525-020-305-b, "General Interest Data Collection", outlines the District's responsibilities for updating the RHC data base.

```
RHCTS01A 00 272159                                                   12/13/89 15:16:05
RHCB003          RAIL-HIGHWAY CROSSING CLASSIFICATION/LOCATION               PAGE 01
** FIELD NAME ***  *** CONTENTS ***      ** FIELD NAME ***   *** CONTENTS ***
RR CROSSING NO.    272159                PRIV.-XING CATE.    0     (UNKNOWN      )
CHECK DIGIT        U                     PRIV.-XING TYPE     0     (UNKNOWN )
RR COMPANY ID      F     (FLORIDA EAST)  PRIV.-XING PROT.    0     (NONE    )
RR CO. LINE NO     410   (FEC BUNNELL-)  PROTECTION DESC.
RR DIVISION                              PUB.-XING TYPE      1     (AT GRADE)
RR SUBDIVISION                           RR-XING STATUS      O     (OPEN         )
DOT COUNTY CODE    88    (INDIAN RIVER)  STATUS DATE         11/15/83
CO. MAP REF. NO.                         PROPOSED STATUS     N     (NO USE, OPEN)
SECT.TOWN.RANGE                          PRIOR ID/LINE NBR   F410
CITY CODE          2150 (VERO BEACH  )   DATE LAST UPDATED   03/02/89
NEAREST CITY?      N                     NEW ENTRY FLAG      N
DISTRICT CODE      4     (FOURTH)
LOCAL STREET NAME  ROSELAND RD
ALT. RR-XING ID
NEAREST TIMETABLE  496720 (VERO BEACH)
RR CO. MILEPOST    0212.57
RR BRANCH NAME     MAIN
PEDES.-XING TYPE   0     (UNKNOWN )

RHCTS02A 00 272159                                                   12/13/89 15:16:35
RHCO004              RAIL-HIGHWAY CROSSING SAFETY DATA                       PAGE 01
** FIELD NAME ***  *** CONTENTS ***      ** FIELD NAME ***   *** CONTENTS ***
SAFETY INDEX DATE  07/07/89
ACCI.POTENTIAL     -2.60469
PREDIC. ACCI./YR   000.061
ADJ. PREDICTION    000.101
SAFETY INDEX       58.02
SAFETY INDEX RANK  0370
RECOMMEND.WARNING  04    (FL & G     )
RECOMMEND. COST    0000.0

RHCTS03A 00 272159                                                   12/13/89 15:17:37
RHCB006              RAIL-HIGHWAY CROSSING RAIL OPERATIONS                   PAGE 01
** FIELD NAME ***  *** CONTENTS ***      ** FIELD NAME ***   *** CONTENTS ***
EFFECTIVE DATE     07/18/86              OTH.RR CODES-DIFF
THRU TRAINS A.M.   12                    OTH.RR SAME TRK?    N
SWITCH TRAINS A.M  00                    OTH.RR CODES-SAME   000
THRU TRAINS P.M.   12                    TYPE RAIL TRAFFIC   6     (FREIGHT, THR)
SWITCH TRAINS P.M  00                    DATE LAST UPDATED   06/18/86
LESS 1 TRAIN/DAY?  N
NO. TRAINS/UNIT    24
UNIT OF TIME       DA    (DAYS   )
MAX TRAIN SPEED    065
MAX SPD. EFF.DATE  11/15/83
CLASS OF TRACKS    0     (UNKNOWN      )
TYP.MIN.TRAIN SPD  050
TYP.MAX.TRAIN SPD  060
NO.MAIN RR TRACKS  1
NO.OTHER RR TRKS   00
TYPE OF OTHER TRK
HORIZONTAL CURVE   00.0
OTH.RR DIFF.TRK?   N

RHCTS04A 00 272159                                                   12/13/89 15:18:14
RHCB009              RAIL-HIGHWAY CROSSING WARNING DEVICES                   PAGE 01
** FIELD NAME ***  *** CONTENTS ***      ** FIELD NAME ***   *** CONTENTS ***
LAST FIELD REVIEW  06/10/88              NO. WIG WAGS        0
NO WARN DEVICES?   N                     NO. BELLS           1
NO.REFLECT.X-BUCK  2                     SPEC.WARNING DESC
NO.NON-REFLECT XB  0                     COMMERCIAL POWER?   Y
NO.STD. STOP SIGN  0                     TYPE TRAIN DETECT   9     (UNKNOWN      )
NO.OTH. STOP SIGN  0                     SIDESTRT WARNING?   U
NO. OTHER SIGNS    0                     TRN-ACT.ADV.WARN?   N
OTHER SIGNS DESC.                        PREEMPT. ADJ.INT?   U
NO.OTHER SIGNS(2)  0                     XING ILLUMINATED?   U
OTH.SIGNS(2) DESC                        LAST UPGRADE DATE   01/01/64
NO. RED/WHT GATES  2                     OPTIMAL WARNING?    N
NO.OTH.COLOR GATE  0                     DATE LAST UPDATED   06/22/88
NO. CFL OVER TRAF  0
NO. CFL NOT OVER   0
NO. MAST FLASHING  2
NO.OTHER FLASHING  0
OTHER FLASH.DESC.
NO.HWY.TRAF.SGNAL  0
```

```
RHCTS05A 00 272159                                                  12/13/89 15:18:58
RHCB012                 RAIL-HIGHWAY CROSSING PHYSICAL DATA                   PAGE 01
** FIELD NAME ***   *** CONTENTS ***     ** FIELD NAME ***   *** CONTENTS ***
DATE LAST UPDATED   06/22/88             MAX.CLR.QUAD DIST   038
NUMBER POSTED?      U                    MAX.CLR.QUADRANT    01   (QUAD 1        )
XING ANGLE CODE     9    (90 DEGREES  )  LAND USE AT XING    2    (RESIDENTIAL )
PAVEMNT STOP BAR?   N                    NO. THRU LANES      02
PAVEMNT RR-XING?    N                    NO. AUXIL. LANES    0
ADV. WARN. SIGNS?   Y                    TRUCK PULLOUT LN?   N
ADV.WARN.SIDESTR?   U                    POSTED HWY SPEED    035
XING SURFACE TYPE   3    (ASPHALT     )  ROAD SURFACE TYPE   18   (ASPH.CONC.SU)
XING SURFACE COND   3.   (FAIR        )  SHOULDER TYPE       7    (OTHER       )
TRACK ON STREET?    N                    SHOULDER WIDTH      000
NEARBY INTER. RD?   N                    MEETS MUTCD STDS?   U
NEAR.INTERS.DIST.   00000
RR PARALLEL ROAD    0    (NONE OR MINO)
TRANSITION TYPE     0    (SMOOTH TRANS)
STOP.SIGHT DST.NE   250
STOP.SIGHT DST.SW   250
MIN.CLR.QUAD DIST   027
MIN.CLR.QUADRANT    03   (QUAD 3      )
```

```
RHCTS06A 00 272159                                                  12/1.
RHCB015             RAIL-HIGHWAY CROSSING HIGHWAY DEPT. INFO                  PAGE 01
** FIELD NAME ***   *** CONTENTS ***     ** FIELD NAME ***   *** CONTENTS ***
DATE LAST UPDATED   06/22/88             RD.HORIZONTAL CRV   00
STATE HWY SYSTEM    3    (PRIMARY    )   VERT.CURVE DEFLEC   00.000
STATE ROAD NUMBER   SR 0505              VERT.CURVE DIRECT
U.S. ROUTE NUMBER                        HAZARD. MATERIAL?   U
ROADWAY SECT. NO.   602                  DEMAND RESP. VEH?   U
SUB-SECTION NO.     000                  NO. SCHOOL BUSES    010
SECTION POINT       002.420              YR.SCH.BUS UPDATE   88
FED.AID HWY SYST.   4    (FA SCNDARY)    NO. TRANSIT BUSES   000
MAINT. RESPNSBLTY   5    (COUNTY     )
URBAN/RURAL ID      R    (RURAL HIGHWA)
FUNCTIONAL CLASS.   3    (RURAL MAJ./U)
NODE NUMBER         00000
WP ITEM NUMBER
WP FUND SOURCE
IMPRV.DENIED LOC?   N
TRAFFIC VOL.(ADT)   004620
DATE OF ADT         06/01/88
PERCENT TRUCKS      000.0
```

```
RHCTS07A 00 272159                                                  12/13/89 15:20:58
RHCB018            RAIL-HIGHWAY CROSSING ACCIDENT INFORMATION                 PAGE 01
** FIELD NAME ***   *** CONTENTS ***     ** FIELD NAME ***   *** CONTENTS ***
FHP ACCIDENT NO.    86088277199
ACCIDENT DATE       01/26/86
INJURY SEVERITY     2    (POSSIBLE INJ)
ACCIDENT DESCRIPT   RAN GATES AROUND  0
ACCIDENT CAUSE      77   (ALL OTHER   )
DERAILMENT?         N
```

1.2 CRASH RECORDS SYSTEM

The crash records system is a cooperative effort between the Department of Transportation and the Department of Highway Safety and Motor Vehicles (DHSMV). According to Florida Statutes, the DHSMV processes all highway crashes, investigated by law enforcement agencies. All agencies utilize the Florida Traffic Crash Report, which is included as Appendix B. This form was introduced with the 1983 crash records and revised for 1991 crashes. The primary purpose of the form was to reduce coding errors and manpower requirements, but many other improvements also resulted. Some of the improvements are as follows:

a. Entering the "from" and "to" node numbers (explained in paragraph 1.3.1) provides direction and enables an edit program to identify coding errors.

b. Provides for identification of oversized vehicles.

c. Provides for identification of hazardous materials.

d. The type of crash list has been updated and includes crash attenuators and other barrier types.

e. Harmful secondary events are identified in addition to first events, i.e., (1) ran onto shoulder (2) sideswiped on-coming vehicle.

The standard crash report contains all the pertinent data recommended by the Uniform Vehicle Code (ref. 4).

1.2.1 Crash Coding

All fatal crashes are reported to the National Highway Traffic and Safety Administration (USDOT) by the DHSMV via the "Fatal Crash Reporting System" which is a direct line computer access. Information as to lane use, roadway functional class, federal-aid system and rail grade crossing number are provided to DHSMV by the FDOT Safety Office. The injury severity codes used by the DHSMV are as follows:

1. No Injury

2. Possible Injury

3. Non-Incapacitating Injury

4. Incapacitating Injury

5. Fatal (within 90 days) Injury

6. Non-Traffic Fatality

These categories are not very useful in determining severity, but a more accurate assessment cannot be obtained without a medical examination. Therefore, the FDOT only uses three categories: No injury (property damage only), injury (combination of # 2, 3 & 4) and fatality (5).

Crash reports for all crashes occurring statewide are initially received and processed by DHSMV to collect certain data items. After processing by DHSMV, all long form crash reports are forwarded to DOT Safety Office. At DOT, a manual sort is done to determine crashes occurring on the state maintained highway system. Crash locators process these reports to identify the crash location by coding distance, direction and node number data. The coded data corresponds to the crash location defined on the Florida Traffic Crash Report (FTCR). Additional data captured from the FTCR form by DOT is the highest injury severity per crash and point of impact identification for safety analysis.

Through electronic data processing the location/node number is verified and the County Roadway Information data, including milepost is assigned. Again, using electronic data processing, keying on the crash number and date, various crash data elements which are recorded by the DHSMV are retrieved and stored. The DHSMV, in turn, retrieves and stores the DOT Safety Office location data for its files.

1.2.2 Crash Storage and Retrieval

Currently, two years of crash report hardcopies are stored in the files. The filed crash reports are for the current year and the preceding year. Prior years are on microfilm sorted by county, state road number, date and crash number. A five year retention of crash records is required.

Receipt of crash records at DOT is usually three to six months after the actual occurrence. Annual crash computer records are generally used to identify past years crashes for microfilm retrieval. The on-line data-base of all crashes located to-date is utilized to define which reports to retrieve for current year information. An automated microfilm document retrieval system is now utilized to retrieve all microfilmed reports.

1.3 CRASH LOCATION SYSTEM

1.3.1 Florida Node System

The purpose of a crash location system is to provide law enforcement personnel a convenient reference device with which to identify traffic crash locations. The crash reference process used in Florida is the node system. The term "node", by definition, refers to a geographical point, or more specifically, a connecting point. Florida's highway network, when viewed on a large scale map of the state, resembles a web-like arrangement. The interconnecting points where streets and highways cross each other are termed nodes. Within the highway network a "cross-fix" (similar to a navigational "cross-fix") already exists in the form of the intersection. Fixed positions exist at every intersection, even where rivers, railroad lines and county lines cross highways. The Florida Node System was designed to uniquely identify these existing fixed points through use of a code number name for each fixed point, or node. This unique code number is tied to a computer that can translate it into a complete and accurate location description. This unique code number is called the Florida Node Number.

In most cases the node number refers to an intersection, but it can also refer to such points as bridges, railroad grade crossings, state boundaries and county boundaries.

The 5 digit node number is unique only within a county. The value of the system is that it can be easily adopted by the cities and counties. In fact, any crash record program that is partially funded by the state or U.S. DOT must adopt the Florida Node System.

On state maintained roads, the numbers are assigned from west to east and south to north (the same direction as the milepost on the straight line diagrams); however, an exact sequence cannot be maintained due to new intersections, extension of highways, access control highways, etc. On one-way pairs separate node numbers are assigned for each direction. A paper record system is now maintained by the Department with node number printouts by county, available to law enforcement agencies through the Safety Office.

1.3.2 Recording Crash Node Data

When reporting a crash, the law enforcement officer describes the location and records the nearest node number, distance, direction and the next node number in that direction. The direction, should be the general direction of the highway (which is not necessarily the compass direction at the crash location). If a node is missing, the officer has been instructed to code the distance to, and the next node number on the same highway.

When a paper node system is used, the law enforcement officer may carry records (usually a computer node printout) that lists the nodes by county and state road in ascending milepoint order. The node location is described by using intersection names, bridge numbers, county line data or railroad crossing information. Smaller communities may elect to assign node numbers to the crash report after it is received in the office (station). In this method the node is identified by the law enforcement officer's description of the intersection, etc. The paper system works best when there is communication between the person assigning the node number and the law enforcement officer.

1.3.3 Node System Coverage

As of December 31, 1990, 11,854 centerline miles of roadway are maintained by the Department. Every crash identified as occurring on the state maintained system has a node number assigned to it either by the law enforcement officer or by the Safety Office. In addition, under the direction of the DHSMV, the node system was expanded to all principal county roads. County officials determined which roads were principal in nature; however, all federal-aid routes and minor collectors were included in this classification. The balance of the node numbered highways are under the jurisdiction of 14 counties. Some counties received funds to establish a crash location reference and record system through a grant awarded by the Governor's Highway Safety Commission (administered under Federal Safety Standards 9 and 10). Included in these grants are funds to implement computer programs for a traffic record system including some correlation with highway data.

Although these are just a few of the 67 counties in Florida, they constitute a major portion of annual crashes. In many of the other counties, almost all of the paved roads are either state maintained or were part of the system designated by the Florida Highway Patrol as principle county roads. Other counties are developing crash report systems. Some of these counties have purchased microcomputers for this purpose.

1.3.4 Integration of the Node System

For the node system to be useful it must maintain a link with the current highway inventory data, plus contain a link with highway crash data. This link, the section and Straight Line Diagram (SLD) milepost described in paragraph 1.1.1, was one of the major considerations during the development of the node system. The assignment of node numbers started in each county when a field crew placed the node number at most intersections and also placed it on the SLD. This physical node system has since given way to an electronic node system with only computer outputs tying node numbers to descriptions of physical locations.

The conversion of the node number, distance, and direction to a section-milepost, is a computerized algebraic process. The distance, in miles, is added or subtracted from the milepost of the referenced node.

1.3.5 The Node Description Record

There is a full description of the node itself that is stored in the County Roadway Information data base. In addition to the basic location information described above, the description of the node includes the following:

a. Class of highway, mainline or subsection (ramp, leg, or second half of one-way pair).

b. Fixture Type. This represents the type of fixture on which the node is placed. It also provides a secondary means of correlating crashes to specific highway features. The following is a list of fixture types:

Description	Code Value
1. Dummy Fixture	00
2. Metal Sign Post	01
3. Bridge Pier	03
4. Bridge Abutment	04
5. County Line Sign	05
6. City Limit Sign	06
7. Sign Post	10
8. Metal Sign Post	11
9. Sign Structure	12
10. Gore Area Drop	18
11. RRX Sign	20

12.	Metal RRX Sign	21
13.	RRX Structure	22
14.	Traffic Control Sign	30
15.	Mile Post Marker	40
16.	Barrier Wall	50
17.	Median Barrier Wall	51
18.	Other Attenuator	80
19.	Hydro Cell	81
20.	Steel Drum (Temporary)	82
21.	Sand Filled Tub	83
22.	Concrete Cell	84
23.	G.R.E.A.T. (Guardrail Energy Absorbing Terminal)	85
24.	Not Posted Yet	90
25.	Fixture Missing	98
26.	Other	99

c. Node Type. This denotes the type of point being referenced by the node number. The following is a list of node types:

	Description	Code Value
1.	Dummy Node	00
2.	Dummy Beginning Section	05
3.	Dummy End Section	06
4.	Dummy Beginning & End Section	07
5.	Intersection	10
6.	Critical Intersection	11
7.	Critical Intersection Beginning Section	12

58.	C/L/R Critical Beginning Section Int.	92
59.	C/L/R Critical End Section Int.	93
60.	C/L/R Critical Beg. and End Sec. Int.	94
61.	C/L/R Beginning State Maintained	95
62.	C/L/R End State Maintained	96
63.	C/L/R Beg. and End State Maintained	97
64.	Milepost Marker	99

d. Nearest City. City codes were utilized (not universally used).

e. State Road Numbers

f. U.S. Road Numbers

g. Intersection Description. Written descriptions (names) of the specific intersections.

The elements of the node description can be adapted for crash studies, and the linking characteristics can be used to plot routes.

1.4 IDENTIFICATION OF HAZARDOUS LOCATIONS

A hazardous roadway condition is a relative term that could mean an obvious, immediately correctable item, such as an object in the roadway. Other obvious hazards, such as obliterated pavement markings, require short term scheduling, These obvious correctable hazards are eliminated by maintenance forces. For the purpose of these procedures a hazardous location is defined as having an abnormal amount of crashes or a high potential for severe crashes, and for which a remedial action is not immediately possible.

A safety engineer is employed in each of the seven districts to investigate hazardous locations, perform analyses and make recommendations for improvements. Hazardous locations may come to the attention of the District Safety Engineer from citizen complaints, Florida Highway Patrol troopers, various incident reports, pavement skid tests, fatal crash reports and other district personnel. All locations should be field investigated. A field investigation will often result in the problem being resolved with a minor improvement by maintenance forces under the betterment program, e.g., curb removal, restriping (channelization) and signing. A caution should be administered on signing; all signing improvements should be reviewed by traffic engineers to ensure that the improvement will correct the problem and signing errors will not be repeated. Projects that require more extensive improvements may be developed as part of the safety programs providing that the location is on the hazardous location printouts, as identified in 1.4.1 through 1.4.6 below. Locations not on these listings must be further justified.

1.4.1 Determining High Crash Locations By Safety Ratio

Each District Safety Engineer receives annual computer printouts of hazardous locations entitled High Crash Roadway Spots and High Crash Roadway Segments. The locations are listed on the printouts in descending order of the safety ratio with any segments or spot location having a safety ratio equal to or greater than one (1.0) and a minimum of eight crashes.

The safety ratio indicates when a segment of highway contains an abnormal amount of crashes. The rate-quality control method uses crash rates as a criteria for identifying high crash locations and applies a statistical test to determine whether the crash rate "is significantly abnormal compared to a predetermined crash rate for segments or locations of like characteristics. The statistical test applied is based on the common assumption that crashes fit the Poisson distribution (ref. 5)."

The purpose of segregating highway segments with abnormal rates is to concentrate field investigation on locations that are most likely to have a high priority for corrective action. The computer program provides printouts of all high crash roadway segments and all the high crash spot locations (mostly intersections). By definition, all highway segments are 0.101 miles to 3 miles and spot locations are 0.1 of a mile or less. Appendices C and D contain examples of these computer printouts.

An abnormal (high) crash segment or spot is determined by the following formula:

$$\text{Safety Ratio} = \frac{\text{Actual Crash Rate}}{\text{Critical Crash Rate}} \geq 1$$

Only those segments or spots with a safety ratio equal to or greater than 1.0 are considered high crash locations.

The Actual Crash Rate is a function of a segment length times the annual number of vehicles in relation to the number of crashes as shown below:

Actual Crash Rate =

$$\frac{\underline{\text{Number of crashes in year (within limits specified)}}}{\text{(Number of vehicles (ADT) x 365 x length in miles)/1,000,000}}$$

= crash per million vehicle miles

The Critical Crash Rate is a function of segment length, traffic volume, and the average rate for the category of highway being tested. For high crash segments, the expression for the critical crash rate is as follows:

$$C=R+K\sqrt{\frac{R}{M}}-\frac{1}{2M}$$

Where:	C	=	Critical crash rate for segments
	R	=	Average crash rate for the category of highway being tested (crashes per million vehicle miles)
	M	=	Average vehicle exposure for one year at the location (million vehicles miles)
	K	=	Constant (1.645 rural, 3.291 urban)

The constant K determines the level of statistical significance of the hazardous location list. For rural locations, a K factor of 1.645 is used. This can be interpreted to indicate that there is a 95 percent probability that crash rates above the critical rate are abnormal, and are, therefore, designated as high crash locations. For urban locations a K factor of 3.291 is used. This indicates a 99.95 percent probability that the crash rates are abnormally high. For spot locations, the following formula is used:

$$H=A+K\sqrt{\frac{A}{V}}-\frac{1}{2V}$$

Where:	H	=	Critical crash rate For spots
	A	=	Average crash rate for category of highway being tested - crashes per million vehicles passing through a spot.
	V	=	Average vehicle exposure for one year at spot (million vehicles)

K = Constant (1.645 rural, 3.291 urban)

The average crash rate is expressed in crashes per million vehicles miles (or crashes per million vehicles for spots) and is the sum of the crashes in relation to the total million vehicle miles driven per year on a particular category of road. The 1990 average crash rates, which are calculated for categories of highways, are listed in Table 2.

TABLE 2. AVERAGE CRASH RATES - 1990

	Segment Rates/MVM			
	Divided Roadway		Undivided Roadway	
Highway Category	Urban	Rural	Urban	Rural
Less than 3 Lanes	1.752	0.536	2.485	0.842
3 Lanes	1.361	0.797	6.390	0.983
4 Lanes	2.344	0.963	2.044	0.158
5 Lanes	4.218	1.408	0.198	0.000
6 or More Lanes	3.241	0.980	0.238	0.000
Main Interstate	1.244	0.278	0.000	0.000
Other Interstate	0.592	0.000	38.461	24.489
Main Turnpike	0.459	0.393	0.000	0.000
Other Turnpike	2.059	0.101	0.000	0.000

	Spot Rates/MV			
	Divided Roadway		Undivided Roadway	
Highway Category	Urban	Rural	Urban	Rural
Less than 3 Lanes	0.986	1.205	1.123	1.479
3 Lanes	0.794	0.000	1.260	1.753
4 Lanes	0.739	0.767	0.986	1.095
5 Lanes	0.630	0.000	1.561	0.000
6 or More Lanes	0.575	0.876	1.452	0.000
Main Interstate	0.191	0.301	0.000	0.000
Other Interstate	0.000	0.000	0.000	0.000
Main Turnpike	0.301	0.575	0.000	0.000
Other Turnpike	4.246	0.000	0.000	0.000

Zero rates indicate either no crashes or no locations were identified for that particular class/category or road.

The computer listing of high crash spots must be utilized with caution. The vehicles considered in the calculations are only those traveling along the route under consideration because records of cross traffic at intersections are not available. This means that the spots having the highest safety ratio are generally those in intersections with the most cross traffic.

Field investigations to determine the problem using crash data as an analytical tool are discussed in paragraph 2.1; however, many hazardous locations can be identified by traffic behavior or built-in substandard features. The engineer should be able to identify the obvious hazardous locations by studying "Highway Design and Operational Practices Related to Highway Safety (ref. 6)."

1.4.2 Listing Roadside Obstacle Crashes

A roadside obstacle, also known as a fixed object, is any permanent fixture off the edge of pavement or in the median. The roadside obstacle printout includes crashes at bridge abutments and piers, bridge rails, curbs, guardrails, permanent barriers, fences, culverts, endwalls, signs, utility poles, trees, mailboxes, and any other applicable fixed objects.

There are two classes of roadside hazards: longitudinal and point. Longitudinal hazards are piers (or a series of), steep slopes, etc. Point hazards are signs, utility poles, etc. If an object is yielding (4-inch diameter aluminum signpost with a wall thickness less than or equal to 3/16 of an inch) or has break-away features (slip base), it is not considered a hazard. Also, obstacles beyond the clear zone (a perpendicular distance from the edge of travelway) are not considered a hazard. Generally, the clear zone width is 30 feet but this may vary depending on side slopes, speed, and type of highway. The width of clear zone is defined in the "AASHTO Roadside Design Guide", 1988 (ref. 7). The treatment of roadside obstacles for new construction, as well as reconstruction, is governed by the Department's Roadway and Traffic Design Standards latest edition, Index 700, entitled "Design Criteria Related to Highway Safety (ref. 8)." The location of obstacles is also discussed in paragraph 1.4.8. The treatment of roadside obstacles on 3R projects is covered in FDOT's 3R Guide (ref. 23).

The computer printout listing of roadside obstacle crashes lists all reported crashes where a vehicle struck an object, regardless of the object's distance from the travelway, or whether the object was yielding or designed with a break-away support.

Each District Safety Engineer can extract a detailed computer printout that identifies the county, section, milepost, and the number of crashes involving fixed objects. This listing may be utilized to determine which highway sections contain the greatest number of fixed object crashes. If the problem is a spot location, the type of crash, type object, and location can be obtained from the detail crash printout. If the engineer is planning to clear a section of highway, then he needs a strip map crash diagram.

1.4.3 Identifying Skid Prone Locations

Sections of highways with a high number of skidding crashes are brought to the attention of the District Safety Engineer in the same manner as other hazardous locations described previously, with one addition. The systematic skid test program, which tests approximately 25-35 percent of the Interstate and Primary Systems per year, accounts for the majority of the highway sections investigated.

The District Safety Engineer receives a computer printout from the Materials and Research Laboratory after testing of a section of highway is completed. The listing contains the location of the tests, the average friction number (FN) for each lane, and other test information. When the FN is in the questionable or review categories as defined in Appendix E-1, "Friction Number Guidelines" the District Safety Engineer conducts further investigation to determine if corrective action is necessary. A FN below 25 is considered undesirable at any highway speed. Standards for use of "Slippery When Wet" signs are explained in Procedure No. 750-000-005-a The Traffic Engineering Manual and can be found in Appendix S.

The District Safety Engineer is responsible for requesting skid tests. Local governments may also request skid tests on a time-available basis. When a possible slippery pavement section has been brought to the attention of the District Safety Engineer, the first step is to obtain an crash summary printout to determine if there is a high number or a high percentage of wet weather crashes. The District Safety Engineer also receives an annual computer printout of each section of highway that has 25 percent or more wet weather crashes, and each section of highway that has 50 percent or more wet weather crashes. When a high frequency of wet weather crashes indicates a possible slippery pavement condition, a skid test is requested from the Materials and Research Laboratory. A direct computer terminal links the laboratory (located in Gainesville) with each district for requesting skid tests. Each skid test is electronically entered into the Skid Hazard Reporting System by the Office of Materials and Research. Skid tests are categorized by pavement type; new pavement, a retest of new pavement or old pavement and placed in a status of 1,2,3 or 9, dependent upon the friction number and highway speed of the roadway section. A flow chart describing the Skid Test Record System is shown as Appendix F.

There are many actions that can be taken for each skid test. A description of the purpose and requirements for each status type is listed in Appendix G. In most instances the District Safety Engineer may place the skid test record directly into the History File by indicating a status of 9 and the appropriate disposition code (also given in Appendix G), i.e. the skid number is adequate and no further action is required by the District Safety Office, Code status 9 and disposition code 91. Similar actions are taken when a construction project is completed (refer to Appendix G). The District Safety Engineer may also include a comment and the date of the comment or status change as desired. It is recommended that dates be entered with status changes to help monitor the progress of potential skid projects.

When a FN is in the questionable or review categories as defined in Appendix E-1, "Friction Number Guides", the District Safety Engineer determines if further investigation is warranted. The current work program is checked to determine if there are any projects that would include the skid test limits. If so, the WPI number, funding source, corrective action taken, and the scheduled year of improvement are entered into the record system. In this way, the project will be tracked to ensure the pavement deficiency is corrected.

When corrective action is not scheduled, the District Safety Engineer is required to determine if there is a crash problem. If a problem exists, the engineer must determine the probable causes of the crash problem. In a case where one factor is slippery pavement, the corrective action would most likely be a skid resistance overlay project to be included in the Skid Hazard Elimination Program. Engineers should be alert for other cross-section and pavement deficiencies such as:

a. Grass shoulder being used for acceleration lane (needs paving)

b. Shoulder drop-offs more than 3 inches

c. Shoulder build-up ponding water on travelway

d. Rutted shoulder - soil cannot sustain growth

e. Serious erosion of ditches on side slope

f. Ditch sections not traversable

g. Evidence of standing water in traffic lane implies lack of surface drainage and may cause hydroplaning (ref. 10, page 14-4).

If other geometrics are involved (in addition to slippery pavement) the project is treated as a hazardous location. The project development procedures for these projects are discussed in paragraph 2.1.

1.4.4 High Crash Roads

Annually the Safety Office provides the District Safety Engineer with a listing of high crash roads. These high crash roads are roadway sections that have had a minimum of 150 crashes in high crash locations totaling not less than 1.75 miles in length with a prorated actual to critical rate ratio of 1.5 or greater.

Once a roadway section is identified on this list it will remain there until the crash trend shows notable reductions below the minimums for selection.

This information should be used in project selection, prioritization and design. The funding source of the projects should not be a factor since safety is a major concern in development of the Department's work program.

1.4.5 Fatal Crash Location

Annually the Safety Office provides the District Safety Engineer with a copy of the "High Fatality Roads List", which is a listing of roadway sections that have had 25 or more fatal crashes within the most recent 5-year period.

The District Safety Engineer also receives a copy of the crash report for each fatal crash occurring on the State Highway System and is required to complete Form 511-14, "Disposition of Fatal Crash". The form is included as Appendix H. The purpose of this form is to ensure that any potential hazardous condition on the highway that may be a contributor to a fatal crash is investigated, and the action taken is recorded. Also, filing the forms geographically causes concentrations of fatal crashes to become evident. Most crashes can be disposed of (filed) without a field review. When a field review is required, it may be conducted by any engineer; however, the recommended action must be concurred with the District Safety Engineer. Examples of crashes requiring investigation are:

a. Any involving deep water bodies (vehicle should not be able to reach water).

b. End of guardrail or any safety feature not performing as intended.

c. Any man-made roadside obstacle.

d. Rough shoulders or slopes.

e. Hydroplaning.

f. Crash at intersection with traffic signals (inform responsible agency if signal may have contributed to the crash).

If a minor corrective action is recommended, it is described on the bottom of the form and transmitted to the appropriate office. A crash study is initiated if it appears a major improvement is needed.

1.4.6 Other Hazardous Location Identification

Annually the Safety Office provided the District Safety Engineer with a variety of listings identifying hazardous locations where crashes with select characteristics exceed a threshold value. These threshold values are considered abnormally high on the statewide basis, however localized conditions may vary widely.

There are two types of threshold values used in producing these listings: percentage values over a one year period and critical crash rate values over a five year period. Since we are dealing with only a fraction of the crash data, a single statewide percentage or rate is used rather than different values for each different roadway class and category as used in the identification of the high crash segments discussed in section 1.4.1.

Hazardous locations identified by high percentages are locations with a high percentage of nighttime crashes and locations where elderly drivers are involved in a high percentage of the crashes. These locations will generally be skewed towards areas with activities related to the crash characteristics. Examples of this are the more nighttime activities, such as bars and nightclubs, the more nighttime crashes, and likewise in elderly communities more the elderly drivers are more likely to be involved in crashes.

Hazardous locations identified by five year high crash rates are large or heavy truck crash locations and pedestrian involved crash areas. Some locations of pedestrian or truck crash problems may be masked by very high traffic volumes thus not appearing on these lists. Some locations may be listed simply because the ratio of exposure to traffic volume is high. An example of this is high volumes of pedestrians in areas with low to moderate vehicle traffic volumes may appear on the list with relatively few collisions.

These listings should be used in addressing the specific crash types identified by the type of listing. HES funds may be used to address these locations, however the primary purpose of the project should address the appropriate crash problem. Refer to Section II of this manual for information regarding project selection.

1.4.7 Inadequate Signing and Pavement Markings

These are subtle highway deficiencies that may have a crash causing potential that is often overlooked, yet may be easily corrected. An engineer traveling the highways should be alert for changing traffic conditions that may render once adequate signing obsolete. For example:

a. Traffic queues may have extended beyond signs that warn of lane drops or exclusive lane use.

b. Increased traffic may necessitate an increase in sign size; or placing directional (route information) signs over travel lanes; or in more advanced locations. The location of routing signs should be far enough in advance to allow decision making and non-conflicting lane change maneuvers.

c. Route markers should continuously direct a driver through an urban area and not create indecision (by omission).

d. Signs that are blocked by vegetation, other signs, bus stop benches, etc.

e. Too many signs for drivers to comprehend.

f. Advance warning sign needed for stop sign.

g. Pavement marking not visible at night on low beams.

h. Color codes on markings are incorrect.

i. Marking pattern is incorrect.

j. Hazards in the roadway are not delineated.

k. Rumble strips are worn.

Traffic and Safety Engineers should be familiar with "A User's Guide to Positive Guidance" (ref. 9) (U.S DOT); especially with decision/sign-distance criteria and information load design.

1.4.8 Highway Safety Features

Often the function of highway safety features is not fully understood by field and maintenance personnel, e.g., guardrail height, hinge points of sign posts. The following is a list of common deficiencies that an engineer should recognize in the field:

a. Guardrail is too high or low. The top of a guardrail for W Beam System (wood or steel post with 6-3" spacing) should be 27" above the ground directly underneath the face of the rail.

b. Guardrail (or any barrier) is located on slope steeper than 10:1.

c. Guardrail is located on rutted slope.

d. Guardrail was not extended far enough to prevent vehicle from reaching hazardous condition (See Index 400).

e. Curb, if present, is in front of guardrail.

f. Gaps in rail system - fill in short gaps less than 200'.

g. Beam overlaps in opposite direction of traffic.

h. Post not securely embedded (i.e., slope should break sufficient distance behind rail with no erosion).

i. Barrier to hazard distance is insufficient (less than 4-feet) or does not have proper stiffened transition.

j. Concrete barrier height less than 29-inches above terrain.

k. Gap in concrete barrier left by removal of utility pole.

l. Approach and trailing rail not securely or improperly attached to bridge rail and protruding points on which a vehicle can snag.

m. Edge of sign less than 2-feet from edge of grassed shoulder or 6-feet from edge of pave shoulder (See Section 2A-24 MUTCD).

n. Crash cushion length insufficient for speed, i.e., only one or two units.

o. Surface under cushion not paved.

p. Curbs in front of crash cushion.

q. Crash cushion structural damage from a vehicle hit.

r. Hydro or Hi-dri Cell-unit not increasing in size as object is approached (designed for uniform width).

s. Hydro or Hi-dri Cell-unit attenuator material level is too low.

t. Hydro or Hi-dri Cell-unit cells leaking or empty (wet pavement).

u. Hydro or Hi-dri Cell-unit cells filled with other than attenuator material.

v. Hydro or Hi-dri Cell-unit stability cables are loose.

w. Sand cushion container damage (cracked, broken split, etc.), sand on ground.

x. Sand cushion cover improperly secured (at least three rivets).

y. Sand drainage not provided.

z. Sand vents to allow moisture evaporation clogged (provided in lid construction).

aa. Sand - both location and weight should be marked on paved pad.

bb. Sand cushions not oriented at 10^{o} toward oncoming traffic.

cc. Sand cushions not placed on outside of barrier, offset at least 30-inches out from hazard.

dd. Sand cushions touching (a minimum 6-inch space between containers is necessary).

ee. Insufficient run out space behind cushion (deadman pocket).

ff. Break-away sign slip plane more than 4-inches above terrain.

gg. Break-away sign washers not provided between slip plates.

hh. Break-away sign hinge joint less than 7-feet above terrain.

ii. Hinge on the wrong side of sign post.

jj. Break-away sign slip base located at the bottom of a drainage channel.

kk. Break-away sign slip base not compatible with situation (i.e., unidirectional for one impact direction, multi-directional when two impact directions are possible).

ll. Break-away sign slip base not included upward away from approach traffic for unidirectional supports.

mm. Fixed hazard directly behind break-away sign.

nn. Sign panel fastened to post below hinge joint.

oo. Traffic Signal - signal poles in median.

pp. Traffic Signal - is clearance at least 4 feet behind face of curb? Preferred location is at R-O-W line. Does pole show evidence of crash?

qq. Traffic Signal - displays (heads) less than 40 feet from stop bar.

rr. Traffic Signal - controller located in probable vehicle encroachment area.

ss. Traffic Signal - amber time insufficient (need one second for each 10 mph of approach speed). MUTCD states range of 3 to 6 seconds.

tt. Luminaire - top of base below normal water line.

uu. Luminaire - top of base higher than 4 inches above terrain.

vv. Luminaire - continuous electrical wiring provided at pole base, i.e., not quick disconnect.

ww. Drainage structure form projects more than 4 inches above ground line.

xx. Grate clogged.

Department engineers should be familiar with "Functional Requirements of Highway Safety Features (ref. 10)."

1.4.9 Identifying Rail-Highway Grade Crossing Hazards

The annual Rail-Highway Grade Crossing Safety Improvement Program may consist of three major elements.

1. Improvement of rail corridors by the systems approach. Corridors are selected that have the highest number of crashes, carry hazardous materials, carry passengers, or for which there are plans to increase rail traffic, thereby the crash potential.

2. Alternate improvements that would be more cost effective than upgrading active grade crossing traffic control devices. This is represented by a lens replacement (8" to 12") program and a constant warning time program.

3. Improvement of the most hazardous crossings based on predicted crash potential.

Improvement of the most hazardous crossings in Florida is based upon the rail system data maintained in Florida's statewide inventory. Each year, the operational and geometric characteristics of every public grade crossing are analyzed by computer, and a safety index is calculated. All public crossings are than assigned a unique statewide priority number based upon the numerical value of the calculated safety index. The annual Grade Crossing Improvement Program is established from this prioritized listing. The prioritized listing also contains an approximate cost of the railroad crossing traffic signal improvement; therefore, the number of crossings that can be improved each year is easily calculated. An example of the priority listing is included as Appendix I. Inventory data collection procedures are described in paragraph 1.1.5.

The priority system is based on a crash prediction mathematical model developed by Florida State University (ref. 11) under contract to the State Safety Office. Statistical consultants at Florida State University utilized stepwise regression analysis, and the following three statistical techniques to develop the crash prediction model:

(1) transformation of data; (2) use of dummy variables; and (3) transformation of the crash prediction model to its original scale. The resulting model is shown in Table 3.

TABLE 3: FINAL CRASH PREDICTION EQUATION

$$t = -9.21 + 1.14\mathrm{Log}_{10}\,(A \times (T + 0.5)) + 0.014V + 0.008S - 0.63L$$

$$P = \frac{2e^t}{1+e^t}$$

Where:

t = A temporary value used to simplify the mathematical expression.

A = Vehicles per day or annual daily traffic

T = Average number of trains per day

V = Posted vehicle speed limit unless geometrics dictate a lower speed

S = Maximum train speed

L = 1 for crossing with active warning devices, and zero for passive or no warning devices.

P = Predicted number of crashes per year

The predicted number of crashes per year (P) is adjusted for crash history. Although this introduces a mathematical bias, it is needed to ensure that all possible hazardous situations are investigated. The crash prediction model explains less than half of the crash environment, whereas human failure is almost always involved. Therefore, locations experiencing non-predicted crashes should receive special investigation. Unfortunately, the phenomenon of regression toward the mean now may apply because a crossing that has 2-3 crashes one year may not have any more until it reaches its actual predicted crash rate. The crash history adjustment equation that is chosen always increases (never decreases) the crash predictor. The following adjustment for crash history is only calculated when the crash history is greater than the crash prediction.

$$P' = P\sqrt{\frac{H}{PY}}$$

Where:

P' = Crash prediction adjusted for crash history

P = Predicted number of crashes per year

H = Number of crashes for six-year-history or since the last warning device upgrade

Y = Number of years of crash history

A simple method of rating each grade crossing from zero to 90 was derived based mathematically on the crash prediction. This method, entitled Safety (Hazard) Index, is used to rank each grade crossing. A grade crossing with a crash prediction of 0.05 or one crash every 20 years would have a Safety Index of 70. A Safety Index of 70 or greater is not considered economical for an improvement. A Safety Index of 60, or one crash every nine years, would be considered marginal. The Safety Index is calculated as follows:

$$I = 90\left(1 - \sqrt{\frac{P'}{MAXP}}\right) - 5Log_{10}(B+1)F$$

Where:

I = Safety Index

P' = Crash prediction adjusted for crash history

MAXP = Maximum value for crash prediction (currently 0.66666)

B = Number of school buses

F = Active or passive warning device factor

Active F = 1

Passive F = 2

The Safety Index is used to indicate the relative hazard of all public grade crossings in Florida. The crossings that exhibit the lowest Safety Index values are given highest priority for installation of warning devices such as flashing lights and gates, or even grade separation structures for extremely hazardous crossings that have frequent train arrivals and high vehicular traffic. Each grade crossing is assigned a statewide priority number based on the Safety Index. The grade crossing with the lowest Safety Index would be assigned priority number one, etc. If there were no fund limitations, the selection of grade crossing for an improvement program would be simplified. However, funds are very limited and it is mandatory to optimize their use to ensure train-vehicle collisions do not rise above the current level, or can be lowered.

FHWA has been a proponent for "people factors," and every index model was thoroughly considered by the Department. As can be seen above, the number of school buses was a factor in the Department's model. This is an indication of the state's concern for school children as the number of school buses crossing the tracks does not directly increase the probability of a crash at that crossing.

Passenger trains in this state utilize the routes with the heaviest train volumes. Therefore, these lines already have high priority for the installation of new or improved warning devices.

Diagnostic teams have been instructed to observe the environment at grade crossings and to note any bulk plants, etc., that might be a generator for trucks carrying hazardous materials.

1.4.10 Identifying Unnecessary Grade Crossings

The best grade crossing is a closed one. Closing a grade crossing is always the preferred alternative. Any grade crossing having all of the following characteristics is a candidate for closing:

a. Less than 2,000 vehicles per day, and

b. More than two trains crossing per day, and

c. Alternative (accessible) crossing within 0.25 miles with less than 5,000 vehicles per day if two-lane highway, or less than 15,000 vehicles per day if four-lane, and

d. Road does not serve as a main alternative route for ambulances, fire or other emergency vehicles, and

e. More than five crossings within any one mile section of a main line track.

District personnel are encouraged to employ closing of crossings as part of the rail-highway grade crossing improvement programs. The Rail Office is responsible for administering the crossing closure program.

The Department under F.S. 335.141 has the authority to close any unnecessary grade crossings. To close a crossing requires an administrative hearing as outlined in Department Rule 14-46.003. This procedure is explained in paragraph 2.3.4.

1.5 LOCAL GOVERNMENT QUALIFICATION REQUIREMENTS FOR SAFETY IMPROVEMENT FUNDS

The Department's methods for identifying hazardous locations are described in paragraph 1.4. These methods generally require electronic data processing and sophisticated computer programs. These programs are adaptable to mini/microcomputer use provided there is sufficient storage space for inventory and crash data.

There are no specific requirements for a county or city to maintain a highway inventory. The requirements for obtaining state or federal funds relate to a crash reference system. The governmental agency is required to identify all the roads under its jurisdiction, but is not required to record the length, width, etc., of the road. The location of crashes is marked by recording the distance from a known point, which is called a Node. This point is (the Florida Node System is described in paragraph 1.3.1) identified by a unique number, road name, intersection or non-intersection, rural or urban, number of lanes and federal-aid system. Many jurisdictions also obtain traffic counts. Thus, a basic inventory is recorded for points along the roadway.

The amount of funds that will be available to local governments will be determined by the Executive Committee of the FDOT with the concurrence of FHWA. For a public body to qualify for safety improvement funds, it must have implemented the following systems and procedures:

a. The uniform Traffic Crash Reference System

b. Traffic Crash Record and Retrieval System (smaller public bodies may utilize a manual system)

c. Develop a method of identifying high crash locations

d. Correlated crash records with highway geometrics

e. Calculated a benefit-cost of the proposed improvements

f. A survey of roadside obstacles within the area of the proposed improvement

The governmental agency must have a method of identifying, comparing and ranking hazardous locations. Traffic count, section lengths (not required for spots or intersections) and annual number of crashes are required. In addition to the number of crashes, the type and severity of each crash must be known. However, this data is not necessary until the cost effectiveness study is complete, at which time this data can be obtained from copies of Florida Traffic Crash Reports. At least two years of crash records are necessary. An evaluation of three years before and three years after the improvement is recommended by FHWA.

Smaller communities could use street maps with color coded pins to identify hazardous locations. Additional rate calculations would be necessary in rating the locations.

A governmental agency wishing to participate in the safety improvement program shall submit its procedures to the Department's Safety Office. The procedures shall include inventory data, method for identifying high crash locations, and a plan detailing how improvements will be evaluated.

SECTION II

DEVELOPMENT, SELECTION AND IMPLEMENTATION OF PROJECTS

2.0 INTRODUCTION

The federal aid and State Highway Safety Improvement Program supports the Department's goal to assure that all transportation facilities are conceived, designed, constructed, maintained and operated in a manner which is safe for the traveling public. This goal is addressed by:

1. The identification of hazardous locations and constructing improvements which will eliminate the cause of as many crashes as possible.

2. Projects to correct known safety deficiencies such as substandard guardrail and roadside obstacles.

3. A rail-highway grade crossing improvement program for all public grade crossings.

The principal sources of funding for safety improvement projects are the Hazard Elimination (HRE) funds, the Rail-Highway Crossing for Protective Devices (RRP) funds, and the Rail-Highway Crossing for Safety Hazards (RRS) funds. Other funds are available for safety improvement projects.

The HRE Program is funded with a 90%/10% federal/state matching ratio. Projects are developed by the Districts following the criteria established by the Safety Office in conformance with federal standards. The type of projects eligible for HRE funds are improvements to hazardous locations as identified in section 1.4.1 through 1.4.6 and skid hazard overlay improvements, based on a benefit-cost (B/C) analysis. Other safety improvements eligible for HRE funding but not requiring a B/C analysis are the elimination or mitigation of roadside obstacles and the elimination of substandard guardrails.

The RRP and RRS Programs are also funded with a 90%/10% federal/state matching ratio. These funds may be used for eligible grade crossings that meet program criteria regardless of ownership of the intersection. Funds are to be used for the installation of railroad traffic signals and other safety work related to traffic control when recommended by the diagnostic team and approved by the State Safety Engineer.

Figure 1. depicts the development, selection and implementation of a typical safety project authorized by the Highway Safety Improvement Program.

In 1984, FHWA Division Office required that crashes be reviewed for each "3R" project. The FDOT State Design Engineer implemented this requirement by letter and included all construction projects. Therefore, the methods for identifying hazardous conditions described in the HSIP Guideline are utilized for all construction projects. As a minimum, this consists of a plans review by the District Safety Engineer who utilizes crash history records to ensure that all crash problems have been addressed by the design. A field review to identify hazardous conditions during the scoping phase is encouraged.

It is the Department's objective that safety be considered at each project phase including planning and maintenance. Districts are encouraged to review "high fatality roads" identified by the Safety Office annually in developing projects for the Work Program.

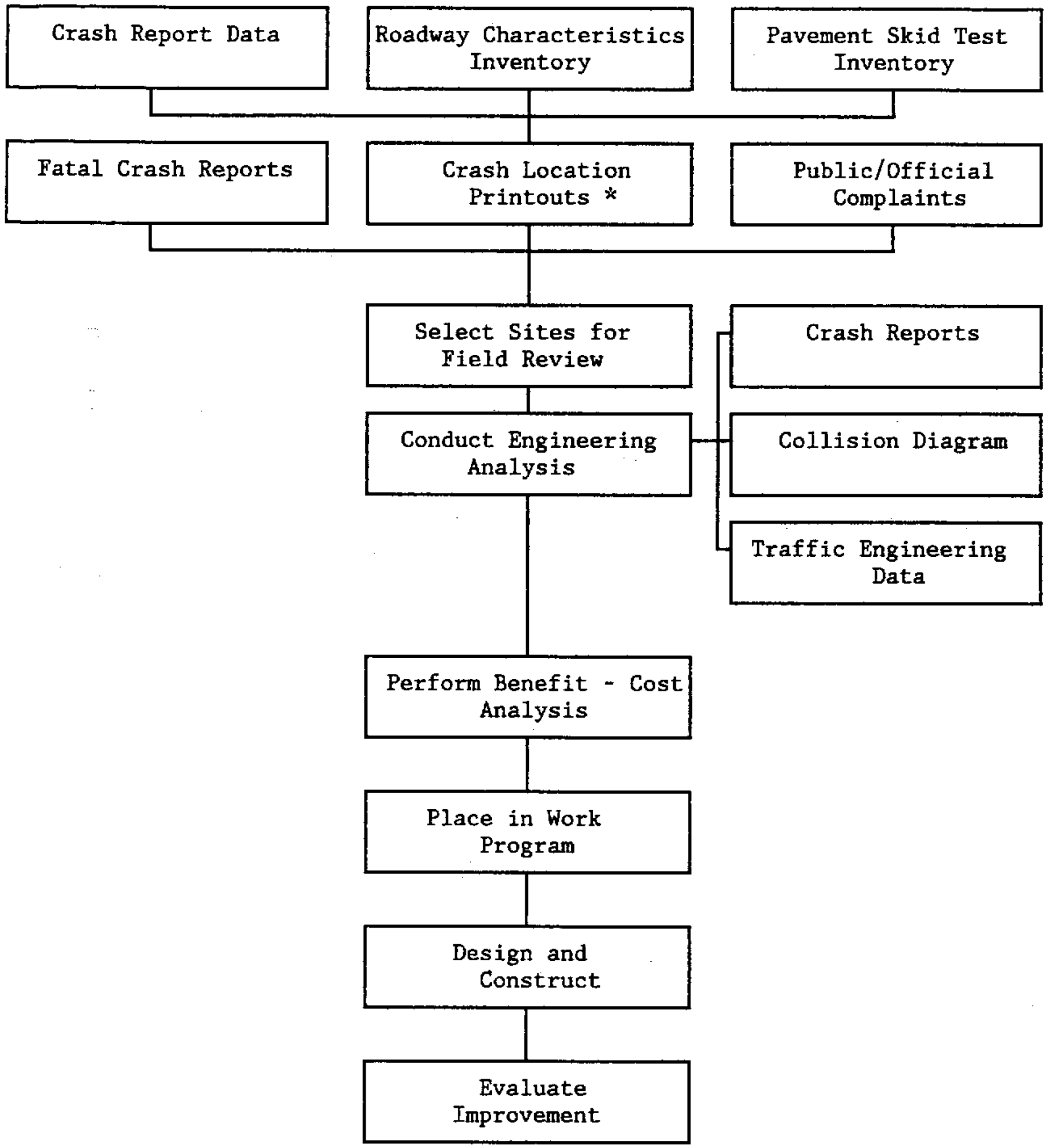


Figure 1. Safety Project Development Flow Chart

* Types of Hazardous Location Printouts Available:

1. High Crash Roadway Segment Listing (Sec. 1.4.1)
2. High Crash Roadway Spot Listing (Sec. 1.4.1)
3. High Percentage of Wet Weather Crashes (25% & 50%) (Sec. 1.4.3)
4. Skid Hazard Reporting System (Sec. 1.4.3)
5. High Crash Roads List (Sec. 1.4.4)
6. High Fatality Roads List (Sec. 1.4.5)
7. High Percentage of Nighttime Crashes (Sec.1.4.6)
8. High Percentage of Crashes Involving Elderly Drivers (Sec. 1.4.6)
9. High Pedestrian Crash Summary (Sec. 1.4.6)
10. High Truck Crash Summary (Sec. 1.4.6)
11. Rail-Highway Grade Crossing Safety Index (Sec.1.4.9)

2.1 HAZARD ELIMINATION PROJECTS

Possible hazardous locations, identified by procedures described in paragraph 1.4, are field investigated to determine if there are roadway elements that may be contributing to crashes. Before the field investigation, as a minimum, the District Safety Engineer should review the Crash Summary. This computer generated summary shows the total number of crashes at the location by type, cause, time of day, weather conditions, etc. Appendix J contains an example of this printout. The cause of the crashes may be obvious, such as rear end collisions at an intersection, or roadside obstacle collisions. When more than 20 crashes occur at a location, discernible patterns often develop.

The crash summary printout can provide many clues as to the crash picture at a certain location. The following are examples:

a. Rear end: vehicle waiting for left-turn, slippery pavement, inadequate traffic signal sequence, inadequate length of storage

b. Left-turns: need left-turn signal sequence, inadequate sight distance

c. Right-turns: inadequate sight distance, traffic pattern conflicts, signing

d. Angle: absence of traffic signal, inadequate sight distance

e. Combination of above: signing, traffic signals

f. Fixed Object: object too close to road, improper cross section superelevation, slippery pavement, grass or poor shoulder

g. Sideswipe passing: slippery pavement, alignment, signing, parking acceleration-deceleration lanes too short, excessive weaving

h. Sideswipe meeting or head-on: slippery pavement, improper cross section or superelevation, inadequate sight distance, excessively long no passing zone, inadequate shoulders

i. Overturning or jackknifing vehicles: slippery pavement, alignment, shoulder drop off

j. Backing: signing, angle parking

Other areas that may provide clues are pavement condition, weather and alignment.

2.1.1 Field Investigation

During the first site inspection, it is likely that the engineer may only be able to list possible causes, note substandard design elements, take photographs and/or sketch the location.

The engineer has the option of requesting and studying additional data, including the original crash reports. These can be requested from the Safety Office. The second site inspection of the hazardous location should include a diagnostic team consisting of one or more engineers of the decision making level from each of the following offices: Maintenance, Traffic Operations, Safety, Design, and if possible, Federal Highway Administration.

The diagnostic team compares the crash events to the geometrics and physical conditions of the roadway. If it is determined that the roadway is a contributing cause of the crash, and/or that a confusing or unforgiving environment exists, probable corrective measures are discussed by the diagnostic team. Those most frequently employed are alignment improvements, left-turn lanes, elimination of roadside hazards, increased acceleration-deceleration lanes to improve weaving characteristics, improved traffic signals, lighting and skid overlay pavement. Sometimes improved signing will reduce the problem; however, there are also situations when signing is the problem itself. Many times a combination of the above solutions, coupled with selected law enforcement is required.

2.1.2 Selecting Proposed Improvements

At any location, there could be a number of distinct improvements which may reduce the number of accidents. Each improvement should be fully discussed by the diagnostic team. The need for engineering studies would probably be identified during the field review. These studies might include the measurement of vehicle speed, gaps, queue lengths, turning movements and other traffic characteristics. Methodology of the studies are outlined in the Department's Manual on Uniform Traffic Studies (ref. 12)."

The elimination of traffic conflicts is the prime reducer of crashes; thus, the optimum solution is to channelize vehicles on cleared, access control highways that provide smooth traffic patterns. The improvements selected should be aimed at obtaining a reduction of traffic conflicts and a control of traffic movements. The improvement of one geometric feature should not conflict with current design standards. With rare exception, turning radii should not be shortened or lane widths narrowed. When widening a highway, consideration should be given to existing roadside fixtures to prevent any increase in roadside obstacle crashes. The District Safety Engineer must ascertain that the required right-of-way is available or obtainable. Due to the time required for obtaining permits, projects involving canals or other waterways, excluding ditches, should be eliminated or recommended to be included as part of the regular construction program.

The various alternatives examined are to be listed separately so that a benefit-cost may be performed on each. For example, at an intersection the installation of left-turn storage lanes with or without traffic signals are two distinct types of improvements. When adding a series of left-turn movements, both the addition of outside lanes with full median, and the removal of the median for continuous left-turn movements should be examined. Any alternative or improvement that alters the project cost should be responsive to alleviating the crash problem identified during the investigation. When a skid overlay is required, it should be listed as a separate alternative.

A typical safety improvement project should be a low cost (less than $500,000) crash reducing project that could be accomplished within two and one-half (2 1/2) years. The calculated benefit-cost ratio should be 2.0 or greater. A benefit-cost ratio above 2.0 allows for a margin of error in the cost estimate and ensures that when design is completed, the project will still be considered viable.

The following type projects are eligible for HRE funding, when they meet minimum requirements shown:

1. A project with a benefit-cost of 1.0 or greater that is identified on a hazardous location listing as identified in sections 1.4.1 through 1.4.6 of this guideline. Locations not on the these listings must be further justified.

2. A skid hazard elimination project with a benefit-cost of 1.5 or greater. Refer to Section 2.2.2 for friction number FN qualifications.

3. The installation of 4 foot wide paved shoulders on rural highways. A benefit-cost of greater than 1.0 should be obtained or project justified on the basis of documented potential hazards and approved by FHWA. The shoulder surface should contrast with the traveled way surface.

4. Elimination of substandard guardrail (No B/C required).

5. Elimination or mitigation of roadside obstacles (No B/C required).

6. Any local government project off of the state highway system with a benefit-cost ratio of 1.5 or greater, meeting the requirements of the FDOT Highway Safety Improvement Program Guideline.

7. Additional criteria may be imposed on the expenditure of funds transferred to HRE from other funding sources. This criteria will be included in the work program instructions when necessary.

2.1.3 Roadside Obstacle Elimination

Field investigation is required to determine the treatment of the obstacles. The installation of guardrails, concrete barriers, crash attenuators or breakaway stanchions only lessen the severity of a crash. Removal of the obstacles to create a 30 foot clear zone is always preferable. Appropriate clear zones for various types of highway facilities, speeds and slopes are discussed in FDOT Standard Index 700, and the AASHTO Roadside Design Guide (ref. 7). Since this is not always practical all alternatives should be considered. The effectiveness of the various treatments is documented in "Accident Reduction Factors for use in calculating Benefit/Cost" (ref. 22). Since each object may require unique treatment and can result in substantial crash reductions it is important to include analysis of roadway hazards during the field investigation.

Engineers involved in the field review should be knowledgeable of the AASHTO "Roadside Design Guide (ref. 7)." The prime objective is to relocate the object beyond the clear zone, preferably on the back slope or behind existing barriers. Gore areas should be kept clear, except for small signs with yielding posts. Medians should be kept as clear as possible. Curbs should not be used in front of attenuators or gore areas.

The need for guardrails should be eliminated whenever possible by flattening or reshaping slopes, removing or relocating obstacles, or making features yielding or traversable. The placement of a guardrail in front of a point object is generally discouraged. Although the guardrail may lessen the severity of a crash, more crashes may occur when a point hazard is transformed into a longitudinal hazard.

Possible roadway deficiencies contributing to roadside obstacle collisions are: shoulder condition, slippery pavement, cross section profile (on horizontal curves or settlement in base toward edge of travelway), and confusing route signing (especially at gore areas).

2.1.4 Project Limits of Improvement

The District Safety Engineer should check the Hazardous Location Printouts listed by county, section, and milepost, to make sure that highway segments immediately adjacent to project limits are not also listed.

The project limits for these projects are governed by the location of the crashes and the optimum utilization of the funds available. As an example, the length of a project may be reduced if the extremities of the segment are experiencing fewer crashes and the cost of improving this area would be greater than the benefit received from reduced crashes. The length of the project may also be shortened if right-of-way or other high cost items are required at the extremities of the project.

2.1.5 Benefit-Cost Analysis

Following field investigation of a location, the District Safety Engineer should complete Form 511-09, Rev. 07/91, "Safety Office Benefit-Cost Analysis", or a similar computerized format containing equivalent information. An example of this form can be found in the manual as Appendix K. A separate form should be completed for each improvement alternative.

All HRE funded improvement projects are to have an engineering report which will include a Project Summary Form, 511-15, 07/91, Appendix M. As a minimum, the engineering report should include statements concerning the type of facility, e.g., urban, curb and gutter, and the environment (business area, highly congested, etc.). A detailed crash analysis should be included in the report, with statements of the crash problem including its correlation with the crash history, the types of improvements proposed and the improvement's effect on reducing certain types of crashes. A sketch of the improvement and a map of the location should also be included. The engineering study for intersection improvements should include warrants for any proposed traffic signals, traffic turning movements, and hourly volumes.

Preparers of the report should be familiar with the Department's "Manual on Uniform Traffic Studies (ref. 12)." The report should also include spot speed studies, gap studies, capacity studies, queue lengths, and traffic characteristics when appropriate. If possible, photographs should be included.

Many items on the form are self-explanatory and will not be discussed. An explanation of Items 3 through 17 is discussed below. It may be necessary for the District Safety Engineer to complete the crash analysis portion of the form (Items 11 through 13) to determine the type of improvements needed for the project. Crash reduction may be determined by the review of crash reports or by crash reduction factors as found in the "Florida Manual (ref. 22, HSIPM)". It is recommended that the "all" crash reduction factor be used instead of factors for type of crash. Reduction factors from other sources may be used if properly referenced.

Item 3. Project No.: Enter section, job number (if available and work program number.

Item 4. Alternative No.: Assign each alternative a number. As an example, skid surface overlay would be an alternative 1 of 4; upgrading of traffic signal, alternative 2 of 4; skid overlay and addition of left turn storage lanes, alternative 3 of 4; all three improvements, alternative 4 of 4.

Item 8. Description of Location: Include local street names and type of facility (e.g. 4-lane urban, divided).

Item 9. Cause of Crash Problems: List each major type of crash and its probable cause, e.g., vehicle in through lane for left-turn causing rear end collisions.

Item 10. Proposed Improvements: This item should be in sufficient detail to allow those reviewing the form to determine the types of crashes that would be affected by the improvement. The description should also constitute a scope that describes the type and range of work to be performed. If an engineering report has been included reference the appropriate pages.

Item 11. No. of Crashes at this Location: Enter the total number of crashes at this location each year for the latest three-year period. Due to the nature of pavements wearing smoother, skid overlay projects may utilize only the latest crash history available.

Item 12. No. of Crashes Potentially Reduced by Proposed Project: If the proposed safety improvement had existed (left-turn lanes), how many fewer crashes may have occurred? For example, in 1988 there were 20 crashes, 10 of which were rear end collisions, and seven of the 10 rear end collisions were the result of the lead vehicle stopping in the through lane to make a left-turn; therefore, seven would be entered for the specific year under Item 12 (assuming a left-turn storage was the proposed improvement).

If crash reduction factors are used as a source, reference documents should be identified in the "comments" section.

Item 13. Type of Crash: The type of quantities of crashes are listed on the crash summary. Enter the data for the years shown in Item 11 on the appropriate line under number of crashes. If the safety improvement affects a type crash other than the eight types specifically listed, then list that type of crash on the first line marked "other". The quantity of each type of crash to be prevented is obtained when calculating the number of crashes to be reduced for Item 12. It should be noted that "wet" and "slippery" crashes at the bottom are not a separate "type" of crash and are also included in the above listing.

Item 14. Crash Information for Facility: The cost per crash is based on figures provided by the Safety Office. Maintenance clean-up costs are also included at $100 per crash. See Table 4 for cost per crash by facility type.

The benefit-cost calculation is based on annual cost. The current interest rate is 7 percent per "FDOT Life Cycle Cost Analysis" (ref. 25). Capital recovery factors for this interest rate are shown in appendix L, HSIPM, "Factors for Annual Compounding Interest (7%)".

Because of changing economic conditions the DSE will be notified by memorandum of any change in interest rate or crash cost by the Safety Office.

Item 15. Annual Cost of Improvement: The cost of each improvement is to be obtained from the District Estimate Engineer. These items are identified separately because they have different service lives. The service life for P.E. - C.E.I. (preliminary engineering and construction inspection charges) is to be equivalent to the major (prime) improvement item. Some normal service life examples are: geometric changes - 20 years; skid overlays - 8 years; traffic signals - 15 years; lighting - 15 years; structures - 50 years; right-of-way - 60 years. These service life estimates are examples and are not mandatory. Generally, roadway costs are anything not covered in the other items and include drainage and geometric improvement costs. Each type of cost is to be multiplied by the capital recovery factor discussed in Item 14 and the result placed under annual cost. Add or subtract the effect of the improvement on the annual maintenance cost (change in maintenance). Some improvements, such as traffic signals, increase maintenance cost. Subtract the crash cleanup (reduction in maintenance costs due to reduced crashes) which is obtained by multiplying the average number of crashes reduced (Item 12) by $100. The result is (for purposes of this analysis) the total annual cost.

Item 16. Annual Benefits: The benefit is derived from the annual average reduction in crashes (Item 12). The average number is multiplied by the cost per crash for that type of facility improved. These costs are discussed in Item 14.

Crash reduction costs are the only benefits used for these analyses. The Benefit-Cost ratio is obtained by dividing the total benefit by the total cost.

The completed Form 511-09 will be signed by the District Safety Engineer. On September 12, 1988 the FHWA approved the Department's request to utilize certification acceptance for HRE funded highway safety improvement projects. This process is described in Procedure No. 500-000-200-a, Appendix Q. It will apply to selection, design, construction and administration of the projects.

Also included in Appendix Q is a memorandum of March 10, 1989 from Mr. Ben Watts, Secretary of Transportation, pertaining to processing projects under certification acceptance. This memorandum contains instructions for file retention and responsibility.

TABLE 4. COST/CRASH BY FACILITY TYPE *

	Divided		Undivided	
Facility Type	Urban	Rural	Urban	Rural
< than 3 Lanes	$22,400	$46,400	$28,000	$74,800
3 Lanes	22,400	46,400	18,300	46,400
4 Lanes	26,000	59,100	19,800	47,200
5 Lanes	17,700	41,100	25,900	47,200
6 or More Lanes	22,100	41,100	17,300	47,200
Main Interstate	29,500	71,100	29,500	71,100
Other Interstate	29,500	71,100	29,500	71,100
Main Turnpike	38,800	71,500	38,800	71,500
Other Turnpike	38,800	71,500	38,800	71,500

* Derived from 1988, 1989 and 1990 crash data

2.1.6 Implementation

The governing factor for project implementation (selection and scheduling) is the amount of funds allocated. The allocation of funds is governed by federal appropriations and state policy on distribution of funds to the districts. The amount of allocation is established by the Secretary and the Executive Committee. Five year funding levels are published annually in the document entitled "Multi-Year Work Program Instructions" prepared by Program Development. Districts are instructed to schedule at least three years of projects.

2.1.6.1 Project Selection

The District Secretary, recognizing funding restrictions, may select a lesser cost alternative than the one with the highest benefit-cost ratio. Final selection of safety projects by the District Secretary will be based on the benefit-cost ratios as well as the district's transportation needs (expected growth areas), future construction programs and liability considerations.

2.1.6.2 Project Scheduling

Considering priorities established by the District Secretary and fund allocations, production personnel schedule projects based on updated estimates, design workloads, environmental permit requirements and projected construction workloads. The program for each fund category is approved by the District Secretary and entered into the Work Program. The District Safety Engineer must work closely with production personnel so that sufficient projects will be ready for inclusion during annual preparation of the Work Program.

2.1.7 Monitoring Projects

The District Safety Engineer must monitor the Highway Safety Improvement Program project to ensure timely progress is made (allowing for budget constraints), and that the project is designed within the original scope. Significant changes in scope and/or cost must be recorded. The District Safety Engineer will revise the scope of the project if there are significant changes on a Project Summary Form (refer to Appendix M). A new benefit-cost analysis will be required for projects with significantly new improvements.

2.2 SKID OVERLAY IMPROVEMENTS

Paragraph 1.4.3 describes when a highway section should be investigated for slippery pavement. Generally, this is when friction numbers have been recorded in the questionable or review categories as defined in Appendix E-1 "Friction Number Guidelines", or the section is experiencing an abnormal amount of wet roadway crashes.

2.2.1 Field Investigation

The District Safety Engineer should field investigate, not only for crash causation and geometric improvements, but also to determine project length.

When reviewing a candidate location for a skid overlay improvement, the geometry should be reviewed to determine the initial cause for skidding; i.e., braking. This may include deficiencies such as inadequate storage lanes or sight distances, an inadequate yellow phase sequence on traffic signals, inadequate warning of a stop situation, substandard cross section profiles, and improper channelization. Each improvement should be evaluated separately for responsiveness in reducing the identified crash problem.

In general, the investigation of a slippery pavement area is the same as the investigation of any other hazardous location. Minor deficiencies in a cross section profile can be corrected by the skid overlay. This minor improvement should not be listed separately, but should be noted in the description of the skid overlay project.

For a skid overlay to be effective in reducing crashes, a significant portion of the crashes should be occurring on wet pavement. Evaluation of past skid hazard improvement projects (Annual Report - "Title II Safety Program, (ref. 13)" 1977-78), found that when at least 25 percent of crashes occurred during wet weather, crashes were more likely to decrease after the improvement.

2.2.2 Selecting Proposed Improvements

The following list of qualifications for selecting projects for the Skid Hazard Elimination Program must be met.

Qualifications for the Skid Hazard Elimination Program

Skid Hazard Elimination projects must be properly engineered to determine if the pavement has a structural problem in addition to a low-resistant surface. If a slick surface is the only major problem, then a friction course, possibly with a minor amount of leveling, can be processed as a skid project. Otherwise, a pavement rehabilitation project should be pursued.

For HRE Funded Skid Projects

A project must have a benefit-cost (B/C) ratio of 1.5 or greater and have a Friction Number (FN) of 28 or less for a posted speed of 45 mph or less, or FN of 30 or less above 45 mph. See Appendix E-1, for Friction Number Guidelines.

For Non-HRE Funded Skid Projects

1. For a Friction Number (FN) greater than 25, a project must have a B/C ratio of 1.0 or greater.

2. For a FN equal to 25 or less, no B/C ratio is required.

The following is a clarification of the three types of projects to be considered as a skid project by the Safety Office and FHWA.

1. The overlay of the existing surface with skid-resistant asphalt.

2. Minor milling and/or leveling of the existing surface and overlay with skid-resistant asphalt. The B/C ratio must reflect the cost of milling, leveling and resurfacing.

3. Mill the existing surface only to increase the friction number to acceptable standards (See Friction Number Guidelines, Appendix E-1.) Milling only is considered a temporary

improvement and should be used to improve an existing hazardous section prior to a future scheduled major improvement for that section. The B/C ratio must reflect the temporary project-life used. Use the crash reduction factor for deslicking pavement as found in the "Florida Manual (ref. 22)."

2.2.3 Project Limits of Improvements

The project limits for skid overlay improvements are based on the location of the skid test, characteristics of the roadway, and crashes. The results of a skid test are considered representative of the entire section of roadway that was constructed (resurfaced) at the same time with the same pavement type, provided there is no significant change in traffic volume along the section. If there are high crash sections adjacent to the skid overlay project that also involve a high number of skidding crashes, they should be included in the project limits. For skid overlays involving only one or two intersections the limits are determined by Traffic Operations, depending on the required stopping distance of the vehicles and expected queues.

2.2.4 Benefit Cost Analysis

The benefit-cost analysis is to be performed as discussed in paragraph 2.1.5.

The following procedures must be used when submitting projects to the District Secretary or his designee for conceptual approval:

1. When submitting a Skid Hazard Resurfacing Project with HRE funding, a Benefit-Cost Analysis (Form 511-09) or a computerized form containing equivalent information must be completed using only the most current calendar year of crash statistics available. The candidate project must have a calculated B/C ratio of 1.5 or greater and have a Friction Number (FN) of 28 or less for a posted speed of 45 mph or less, or (FN) of 30 or less above 45 mph. See Appendix E-1, Friction Number. Indicate the Skid Test ID Number, friction number, and the posted speed within the project limits. A brief engineering report is also required for HRE funded projects (Section 2.1.5). The project file documentation must assure that the skid hazard overlay is properly engineered and that the pavement has no significant structural problems in addition to the low skid resistant surface. The project scope and B/C must reflect any additional work. If there are no other crash causing features except slick pavement, please state as such on the B/C form.

Also required is a Project Summary (Form 511-15). The District Safety Engineer is also required to update the Skid Hazard Reporting System Data Base with the appropriate project information.

2. When submitting a Skid Hazard Resurfacing Project which is **not HRE funded** and a friction number higher than 25, a Benefit-Cost Analysis (Form 511-09) must be completed using only the most current calendar year of crash statistics available. The candidate project must have a calculated B/C ratio of 1.0 or greater. Indicate the Skid Test ID Number, friction number, and the posted speed within the project limits. If there are other accident causing features occurring within the project limits other than slick pavement (accident data supports this), they should be corrected as part of the proposed project. The project file documentation must assure that the skid hazard overlay is properly engineered and that the pavement has no significant structural problems in addition to the low skid resistant surface. The project scope and B/C must reflect any additional work. If there are no other crash causing features except slick pavement, please state as such on the B/C form.

   Also required is a Project Summary (Form 511-15). The District Safety Engineer is also required to update the Skid Hazard Reporting System Data Base with the appropriate project information.

3. When submitting a Skid Hazard Resurfacing Project which is **not HRE funded** and a friction number of 25 or less, it is not necessary to calculate a Benefit-Cost ratio, however, an crash summary is required. If there are other accident causing features occurring within the project limits other than slick pavement (accident data supports this), they should be corrected as part of the proposed project. The project file documentation must assure that the skid hazard overlay is properly engineered and that the pavement has no significant structural problems in addition to the low skid resistant surface. The project scope must reflect the additional work. If there are no other crash causing features except slick pavement, please state as such on the B/C form.

   Also required is a Project Summary (Form 511-15). The District Safety Engineer is also required to update the Skid Hazard Reporting System Data Base with the appropriate project information.

Procedures for Using Crash Reduction Factors (CRF) for Skid Projects

There are many acceptable choices for employing crash reduction factors for skid projects, as found in the "Florida Manual", (ref. 22) when calculating a benefit-cost analysis ratio.

In your development of a skid project, you may use the CRF that gives the most reasonable benefit when the CRF tables give you a choice.

It is best to apply the CRF's to a location experiencing 25 or more crashes per year. For locations experiencing less than 25 crashes per year, crash reduction should be determined by the review of each crash report, and its potential for occurrence had the improvement been in place. Use only the most current calendar year of crash statistics available.

2.2.5 Implementation

Project implementation, (selection and scheduling) for skid overlay improvements are accomplished by following the procedures explained in paragraph 2.1.6. The project description in the Multi-Year Work Program shall include the skid test identification number.

2.2.6 Monitoring Projects

Skid overlay projects are monitored by following the procedures explained in paragraph 2.1.7.

2.3 RAIL-HIGHWAY GRADE CROSSING IMPROVEMENT PROGRAM

At the beginning of each fiscal year, the Safety Office will provide the District Safety Engineer with a "Diagnostic Field Review/Data Sheet" for each priority crossing to be considered in the improvement program.

Other crossings may be included which have been identified through system studies. This element of the program will improve safety of both transportation modes, including the warning systems at grade crossings along segments of selected mainline tracks. Track segments will be selected by the Rail Office for a system safety study based on two or more of the following conditions:

a. Abnormally high percentage of grade crossings with only signs for a warning system

b. Freight trains carrying hazardous material in an environment that presents an unacceptable risk of a catastrophic event

c. Passenger train routes

d. Plans for increased rail traffic, especially commuter trains

An initial review of each crossing number is to be made by the District Safety Engineer to determine if any of the crossings are identified in the work program and scheduled for improvement. Crossings which are not to be considered for improvement are to be noted with an explanation in the area of the crossing data sheet titled "Review Team Recommendation". Crossings which are to be considered for improvement are to be field reviewed by the District Safety Engineer to confirm that the following pertinent information on the crossing data sheet is correct:

a. Existing Protection

b. Posted Vehicle Speed Limit

c. Average Daily Traffic

d. Average number of Train Movements per Unit of Time

e. Number of Through Lanes at the Crossing

f. Average Number of School Buses per School Day

g. Number of Tracks (through and spur)

h. Maximum Train Speed

i. Actual Number of Crashes in Most Recent 6-Year Period or Since Last Crossing Improvement

j. Number of Years in Crash History Record

k. Proposed Crossing Status

If any of the information is incorrect, the District Director of Planning and Programs and/or the Safety Office should be notified as appropriate to correct the data error. A revised safety index will be calculated and a priority number will be assigned by the District Safety Office.

The review of each crossing by the District Safety Engineer should also include:

a. A review of site characteristics

b. Existing traffic control systems

c. Highway and railroad operational characteristics

Based on a review of these conditions, an assessment of existing and potential hazards can be made. If safety deficiencies are identified, the District Safety Engineer will inform the District Railroad Coordinator that the crossing warrants a diagnostic team evaluation of the deficiencies.

2.3.1 Diagnostic Team Field Review

The District Railroad Coordinator is to assemble a diagnostic team to review the crossings provided by the District Safety Engineer.

The purpose of the diagnostic team is to assemble multi-disciplinary personnel who have the necessary expertise and authority to make the appropriate decisions at the grade crossing. Having this team at the crossing will involve the responsible agencies and establish necessary lines of communications.

The diagnostic team should consist of the District Railroad Coordinator, District Safety Engineer, Railroad Company Signal Engineer and a local government representative. Other departmental, or railroad company personnel may participate to the maximum extent possible.

Proper planning and scheduling of diagnostic team activities is essential for manpower efficiency and maintaining public relations. County and city officials will only be needed at crossings within their jurisdiction. The same will be true for those locations needing the expertise of a traffic signal engineer and power company representative. The District Railroad Coordinator should be knowledgeable and experienced in the subject areas. The coordinator will complete a Diagnostic Field Review Report for each crossing to be programmed. This report is included as Appendix N of this manual. A copy of the completed report, including a railroad estimate of cost, should be forwarded to the District Safety Engineer as soon as possible after the review is completed. The District Safety Engineer will be responsible for programming projects in WPA and submittal of projects to the State Safety Engineer. Also included in the submittal are to be the remaining data sheets with an explanation why a priority crossing was not considered for improvement. The Safety Office will review the project reports with a representative from FHWA for conceptual approval.

The diagnostic team will select the appropriate warning system for the crossing based upon the standards in Rule 14.46.003, crash history, observed and recorded traffic characteristics, and the crossing environment. Observation of the following field conditions will assist in the selection of the appropriate warning devices:

a. Driver awareness of the approaching train

b. Visibility

c. Effectiveness of advance warning signs and signals

d. Availability of information for proper stop or go decisions

e. Driver dependence on crossing signals

f. Conditions conducive to vehicle becoming stalled

g. Other traffic control devices contributing to vehicles stopping on the crossing

h. Hazards presented by vehicles required by law to stop at the crossing

i. Signs and signals that are fixed object hazards

j. Roadway geometrics diverting driver attention

k. Location of standing railroad cars or trains

In addition to selecting the proper traffic control devices, the diagnostic team shall examine the crossing environment for other correctable hazards and needed work. A review of crash reports aids in this effort. The following types of construction work may be needed: installation of traffic signals, curbs and gutters in urban areas, fill and drainage improvements; other items such as improving a turning radius or paving the shoulder across tracks if the presence of a railroad signal increases the hazard of the existing substandard condition; or items such as utility relocation or tree removal to obtain an unobstructed view of the signal.

In most cases, the improvements needed will be minor and can be performed by the public body maintaining the highway (which should have representatives at the site review). In rare cases, it may be desirable to improve substandard features that are extremely hazardous. This could include large culverts immediately adjacent to the travelway, extremely deteriorated grade crossing surfaces, or the addition of a deceleration lane on a nearby high-speed parallel highway. These additional improvements should be scheduled along with the signal work if they affect the installation of the signal poles, of if traffic flow would be adversely affected if the improvement was not accomplished.

Each crossing should be checked for potential utility conflicts. Any conflicts should be noted on the Diagnostic Field Review Report. If modification to existing utilities is required, or if any other action by a utility company is necessary, the District Utility Coordinator should be notified. In determining the supplemental improvements for each crossing, the review team should consider the FHWA requirements, which states that related signs and markings must conform with the "Manual on Uniform Traffic Control Devices (ref. 14)." The team should also consider the possibility of closing the crossing.

An important design criterion is the establishment of a clear approach zone to the lights. This zone will facilitate motorist recognition of the crossing as a potentially hazardous location and ensure adequate visibility and response to the active warning devices. The approach to each grade crossing should have a clear zone that is at least 12 feet wide (from edge of travelway), beginning 75 feet from the tracks. It should also extend 25 feet beyond the far side of the tracks. Only railroad-crossing related small signs may be in the clear zone.

The location of signal and gate assemblies should conform to Index 17882 of the latest "Roadway Traffic Design Standards (ref. 15)" when possible. However, field conditions often indicate deviation from the offsets specified in the index. If this condition exists, it should be noted in the diagnostic report.

The offsets specified in Index 17882 serve as design standards for locating signal assemblies; they are not intended to be furnished to the installer for interpretation of device location. Determination of the exact location of signal assemblies is the review team's responsibility, and this information should be contained on plan drawings separate from the index and included in the PS&E assembly.

The type of recommended railroad warning device for each grade crossing is included in the priority listings provided the districts. This recommendation is based on input to the computerized data base. Field conditions may dictate a signal assembly that differs from that recommended on the printout. The factors that dictate the type of signal assembly to be selected by the diagnostic team are provided in paragraph 2.3.2.

2.3.2 Railroad Crossing Signal Criteria

a. Flashing Lights: The standard train-activated warning device is the roadside flashing light. This consists of back-to-back pairs of flashing lights supported by a signal mast. At least one pair of 12 inch roundels shall be focussed on each approach. The location of the mast is specified in Index 17882.

The roadside flashing light is utilized at rail-highway grade crossings that are basic single track, two-lane intersections. Factors that would complicate the decision making of the driver are not present.

The signal mast is normally installed on the right side of the approach; however, an additional mast may be installed on the left approach in order to direct a pair of roundels, a left angle curve, or side road.

b. Highway Traffic Control Signals: The use of highway traffic control signals in lieu of railroad crossing flashing light signals is not permitted by the "Manual on Uniform Traffic Control Devices" (ref. 14) for main line tracks. It does permit the use of highway traffic control signals at industrial track crossings and other places where train movements are very slow (less than 25 mph).

   At locations where the track(s) passes on a diagonal through the highway intersection, it may be difficult to erect two traffic control systems without one obstructing the view of the other. In this situation, it is permissible to use highway traffic control signals in lieu of flashing lights. The signals shall be constructed and maintained as highway traffic control signals with a preemption phase upon the approach of a train. The signals shall have standby power available.

c. Cantilever Arms: If geometrics require the roadside signal location (center of pole) to be greater than 25 feet from the centerline of a two-lane roadway, then cantilevered arms should be considered. Cantilevered arms are required on multi-lane highways. Cantilever arms may be employed to enhance the visibility of signals when excessively brilliant or flashing lights appear (or would appear) in the background of roadside signals when viewed from the approach travelway. Night investigation may be required to determine this.

   Likewise, care should be taken to ensure that cantilevered signals are not positioned in a way that they form a distracting background or obstructive foreground for traffic signals or overhead lights.

   The location of the supporting masts is described by Index 17882. This Index also provides for the roundel location. At least one pair of backlights should be on the cantilevered arm.

d. Gates: Department Rule 14-46.003, "Highway/Railroad At-Grade Intersections; Authorizations for the Opening and Closing", details the condition under which gates are required to be installed. Any of the conditions listed below shall require gates:

1. Multi-lane highway

2. Multiple mainline railroad tracks including passing tracks

3. Multiple tracks at or adjacent to the crossing which may be occupied by train, thereby obscuring the movement of another train approaching the crossing

4. High speed operation (greater than 65 mph) or commuter train operation (greater than 45 mph)

5. Traffic counts greater than 5,000 vehicles per day

6. Greater than 30 through trains a day

7. Traffic with greater than 9 school buses per day and/or substantial number of trucks carrying hazardous materials

8. Continuance of crash history after installation of flashing lights

9. An intersection within 200 feet of tracks (measured from the edge of travelway), providing intersection has traffic signals and/or there are heavy turning movements from a parallel highway onto the tracks

Requirements for the configuration of the gate arm are in Section 8C of the "Manual on Uniform Traffic Control Devices (ref. 14)." The location of gates is described in Index 17882.

e. Bells: The crossing bell is an audible warning signal required as a supplement to other active warning devices. The bell unit shall be mounted on top of at least one of the supporting masts of the flashing light signal. As the maximum sound emanates from the rim of the gong, the bell should be positioned so that the gong is parallel to the sidewalk or street. The bell may interact with the flashing lights in various ways. The bell sounds whenever the flashing light signals are operating. When gate arms are used, the bell circuitry may be designed so that the bell stops ringing when the lead end of the train reaches the crossing or when the gate arms descend to within ten degrees of the horizontal position. Silencing the bell when the train reaches the crossing or when the gates are down may be desired to accommodate residents or suburban areas. When there is substantial pedestrian traffic, bells shall be installed on each signal mast adjacent to a sidewalk.

f. Illumination: Regardless of the type of warning system employed at a grade crossing, illumination can improve the effectiveness of the warning devices during night operations. Overhead illumination should be considered whenever the following three conditions are met:

1. An average of more than three trains each night

2. Train speed of less than 30 mph

3. Commercial power is available

Illumination should also be installed if crash history indicates motorists have difficulty in detecting train or control devices at night. Recommendations for placement and type of luminaires are available in the AASHTO Lighting Guide (ref. 16), and from the Illuminating Engineering Society's "American National Standard Practice for Roadway Lighting (ref. 17)." On uncurbed roadway, luminaire supports should be erected as far as practical from the traveled way (20 feet is desirable; 12 feet is minimum). On curbed roadways, 4 feet from the curb is desirable, 2 feet is minimum. Because of their proximity to the roadway, luminaire supports should have breakaway (frangible) bases. The luminaires should be carefully positioned to ensure that the motorist or railroad operator is not subjected to glare from the light source. If glare cannot be eliminated, cutoffs should be provided to shield the cone of vision of the motorist or train operator. In rural areas with high train speeds, some lighting should be directed down the tracks to illuminate the sides of approaching train.

g. Influencing Intersection: At a grade crossing where the movement of vehicles across the tracks is routinely halted by a signalized intersection, a railroad preemption sequence must be added to the traffic signal operation if it does not presently exist. Consultation with local traffic engineers or peak period observations may be necessary to determine if queues extend onto the crossing. All signalized intersections within 200 feet of the grade crossing must be provided preemption capability. At crossings where interconnection of traffic and railroad signals presently exist, and vehicles stopping on the tracks continue to be a problem, alternate solutions may be applicable. These problem crossings should be brought to the attention of the Safety Office.

h. Stopping Distance Sight Restrictions: An advance warning light may be installed at locations where vertical or horizontal curves obstruct the view of the railroad warning devices at the crossing. Refer to Index 17882 for details. The advance warning light may also be considered on high speed highways that employ gates at the grade crossing if additional devices are needed to slow the approaching traffic, e.g., high speed road in rural area with long distances absent of speed changes.

i. Roadside Obstacles: At signal locations where the roadside clear recovery area is 20 feet or greater (from the edge of the travelway) the signals themselves become a roadside obstacle. Crash attenuators should be considered at these locations. If deemed necessary, they should be installed on the side of the signals facing incoming highway traffic. Refer to paragraph 2.1.3. At grade crossings where roadside obstacles (such as power poles, trees, or culvert headwalls) are present along the approach to the grade crossing, and are within the 20 foot recovery area, crash attenuators at the railroad signals may be omitted. On streets with speed limits below 50 mph, the railroad signals are not considered an obstacle if they are behind curbs or sidewalks.

j. Train Speed Detection Devices: It is recommended that motion sensors and standby signal control equipment be installed on mainline tracks and heavily used spur tracks as part of the grade crossing signal equipment. The equipment may be installed on any track recommended by the railroad company and approved by the Department.

Developments in the application of solid state circuitry have made the use of constant warning time detection devices feasible. These devices when properly employed, eliminate unnecessary delay to vehicular traffic and enhance the credibility of railroad warning system operations. Therefore, constant warning time devices should be installed at grade crossings where the minimum scheduled train speed (not including "slow orders") is 30 miles per hour slower than the maximum scheduled train speed for same track, and the average daily traffic utilizing the crossing exceeds 10,000.

2.3.3 Programming and Scheduling

Upon receipt of the diagnostic field review report, the District Safety Engineer should enter the viable projects into the work program with assignment of a work program item number and cost estimate. The work program description must include the national crossing number.

On November 17, 1988 the FHWA approved the Department's request to utilize alternate procedures in the management of rail-highway grade crossing safety projects funded with RRS And RRP funds, Appendix R. Administering the rail-highway grade crossing safety program under this alternate procedure offers significant time-saving advantages to both the Department and FHWA. Under this procedure, FHWA activity will be limited to approving the annual program of projects, approving environmental determinations, authorizing projects and obligating funds, entering project agreements, performing final inspection and acceptance of the projects and approving final vouchers. Normal project activity not specifically addressed in the procedure is the responsibility of the Department to carry out.

2.3.4 Implementation (Closing Grade Crossings)

Any non-essential highway traversing a railroad track should not remain open. Upon identifying such a location, District personnel should initiate a study to determine the feasibility of closing the crossing. In analyzing particular crossings for possible closure, the following factors should be considered:

a. Negative Impact to Local Transportation System: Foremost in considering this important factor is the existence of alternate public crossings that provide reasonable travel times to motorists who are forced to use different routes. Alternate crossings must have sufficient capacity to accommodate the diverted traffic in a safe and efficient manner. Connecting roadways between the terminated approaches to the closed crossing and the approaches to the alternate crossing must also be suitable to carry the type and volume of diverted traffic.

b. Emergency Vehicle Routes: No crossing should be closed that serves as a main alternative for ambulances, fire trucks, or other emergency vehicles.

c. Potential Hazards: The crash experience or hazard potential for the crossing under study should be carefully evaluated. Data items that should be reviewed include:

    1. Number and severity of crashes

    2. Type and number of trains

    3. Train speed range

    4. Time periods that crossing is blocked by train

d. Hardship to Local Businesses: The economic impact to existing or planned nearby businesses whose patrons or delivery vehicles utilize the crossing considered for closure should be studied.

e. Compatibility with Local Growth Plans: City, county, and state planning agencies should be consulted to determine if closure of the crossing and resulting changes in travel patterns are compatible with established growth plans.

f. Future Changes in Railroad Traffic: Each railroad company operating over a crossing considered for closure should indicate in detail its intent for future utilization of that section of track. If abandonment is anticipated, closure proceedings should cease.

The next step is to present the recommended closure program to public and local government officials. A presentation should be conducted to detail the objectives of the program and illustrate the safety benefits to the public.

The general portion of the presentation could include a government or industry film depicting grade crossing hazards. Statewide statistics regarding injury severity of train-vehicle collisions should be provided. Examples of similar crossings in other cities or counties that were successfully closed should be discussed.

Maps should be displayed showing "before" and "after" traffic patterns, capacities, and volumes for each crossing to be closed. The benefits and costs associated with the closure should be presented and discussed.

If the public body agrees to a closure, authorization should be obtained from the Rail Office. The project should then be entered into the Work Program. A public hearing shall be requested pursuant to Chapter 120, F.S. If the public body does not agree with the closing, the District/Rail Office may go ahead with closing proceedings if it is decided to be in the public interest. The Department rule that governs the opening and closing of grade crossing is 14-46.003 - "Highway/Railroad At Grade Intersections Authorization for Opening and Closing Crossings".

Funds that have been established for a Rail-Highway Grade Crossing Improvement Program may also be available to close a grade crossing. Those are costs associated with terminating the highway approaches, providing or improving access to an alternate crossing, and upgrading or installing signals or improvements.

SECTION III

EVALUATION

3.0 INTRODUCTION

This section discusses three types of evaluations. The most common is the Before and After Evaluations, which is an evaluation to determine a project's effectiveness. The second is a Detail Evaluation, which includes an analysis as to the type of crashes and their relationship with the type of improvement. The third is a Program Evaluation, which can be used as an aid to managers in their decision making processes. An assessment of Department activities in implementing highway safety improvements is conducted on an annual basis.

The objective of evaluations is to determine the effectiveness of Highway Safety Improvement Programs. This will improve the Department's ability to properly allocate scarce funds to high pay-off improvements and divert funds from projects that, are marginal or ineffective.

This section was developed with extensive use of material found in "Highway Safety Evaluation Procedural Guide (ref. 18)", and supplemented with material found in the "Highway Safety Program Management Manual (ref. 19)."

3.1 GENERAL EVALUATION PROCESS

Some basic evaluation procedures are common to all three evaluation types discussed in paragraph 3.0. In general, the following five basic steps are used in the evaluation process:

a. Selection of projects
b. Selection of evaluation method
c. Data collection
d. Statistical tests to determine the significance of evaluation results
e. Documentation of results

A discussion of how the above procedures relate to the general evaluation process is contained in the following paragraphs. More detailed information for each of the three evaluation procedures is contained in the paragraphs describing the specific evaluation.

3.1.1 Selection of Projects

All projects funded by the Highway Safety Improvement Program are to receive Before and After Evaluations to determine if they were effective in reducing crashes. Some of these projects are selected for Detail Evaluation (refer to paragraph 3.3).

Other construction projects that include significant safety improvements are also to receive before and after studies providing the following information is available.

a. Project location (including milepost)
b. Construction completion date
c. Project budget item and job number
d. Project cost
e. A detail description of the improvement (to determine type of crash reduction)
f. Confirmation that additional improvements were not made during the evaluated period

Certain improvement projects are better evaluated by using the aggregate method and thus becoming Program Evaluations. In a Program Evaluation, the sum of before and after crashes for a group of locations is examined. These are spot type projects that have a very low crash history, such as: rail-highway grade crossings, crash attenuators, guardrail installations, bridge approach treatment, and installation of other safety devices.

Procedures for evaluating selected projects and programs are illustrated in Figure 2.

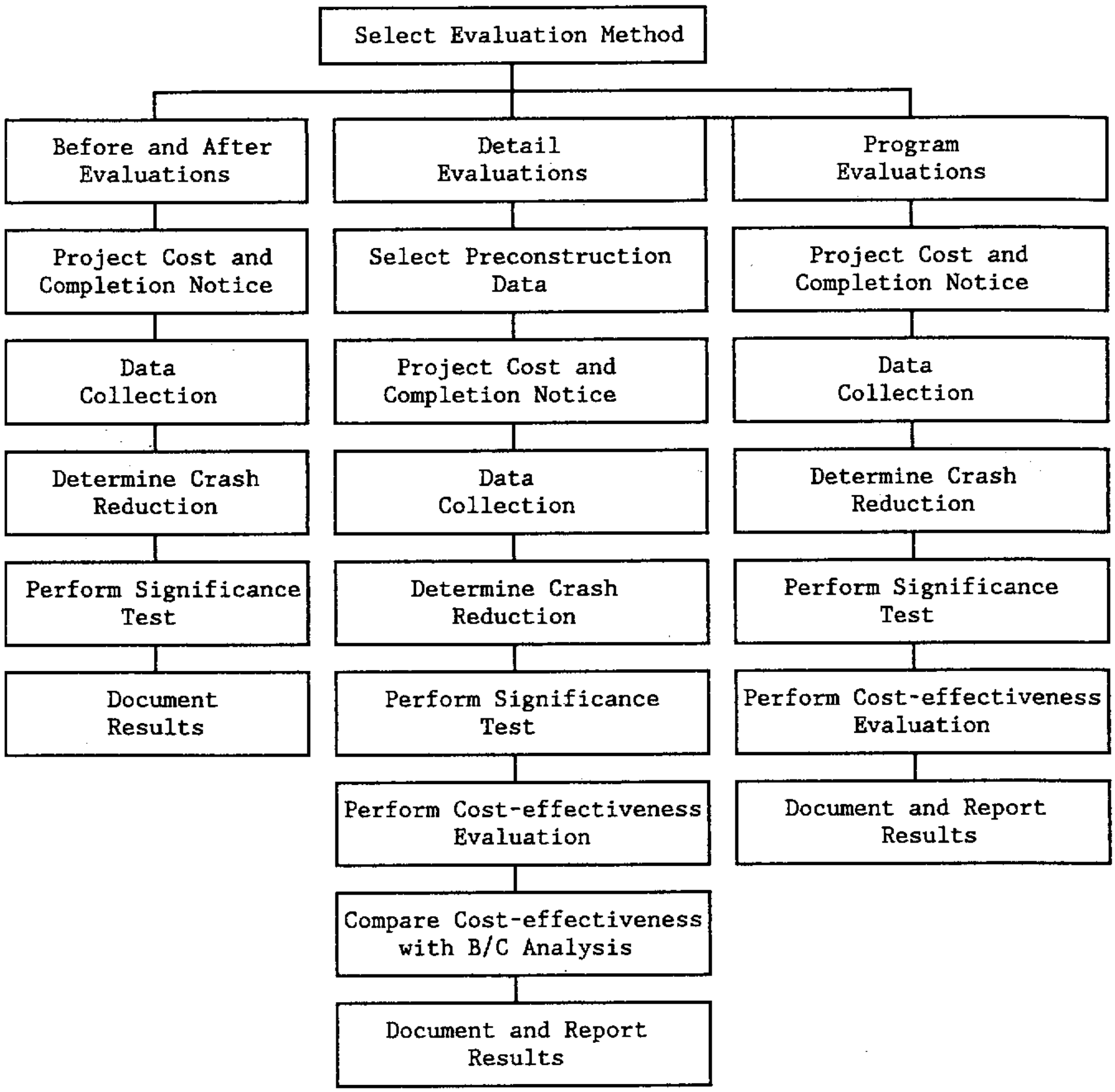


Figure 2. Evaluating Highway Safety Improvements.

3.1.2 Establishing Project Limits

The beginning and ending milepoints for crash data limits depends on the type of location and type of improvement. For linear improvements, such as lane widening, the before and after crash data should be within the milepoints that define the physical limits of the improvement.

Improvements at non-intersection spot locations, such as sight distance improvements and warning sign installations, may have an influence on crash experience beyond the immediate improvement location. On the other hand, "spot" improvements of a more linear nature, such as guardrail installation, only affect crash occurrence within the physical limits of the improvement. Therefore, before and after crash data for spot improvements should specify the milepoints that define the physical limits of improvement, unless this distance is shorter than 0.1 mile on either side. For example, if warning signs are placed on either side of a sharp curve, obtain crash data for the area between the two signs or for 0.20 miles, whichever is greater. Some judgment may be necessary to avoid influences from roadway features unrelated to the spot improvement. For example, if the above guidelines cause the milepoint limits to be extended to include crash data for a nearby unrelated intersection or commercial entrance, the limits should be shortened to avoid this influence (ref. 19).

Improvements at intersections are more difficult to evaluate because of the extent of influence of improvements on intersection-related crashes. For example, an intersection improvement may affect crash occurrence more than one block away if traffic congestion extends beyond the next intersection. However, as the distance for an improvement increases, the probability of other influences also increases. Therefore, the project limits for an intersection is generally 0.1 of a mile. Before and after crash data should be requested for a distance of 0.05 miles from the intersection of each approach leg (ref. 19). Crashes that occur where local streets intersect state roads are regarded as located on the state road if the reporting officer indicates that the crash was intersection related.

3.1.3 Data Collection

The following basic data must be obtained prior to evaluating any project.

a. Project length and cost. This information can be obtained from the Work Program (WPA) file with either an item or a job number.

The milepost can be obtained from the project description and using straight line diagrams. Cost should include preliminary engineering, right-of-way, project construction and construction engineering.

b. The crash data needed for most projects can be obtained from the detail crash summary printout. For detail evaluation, copies of the crash reports can be obtained from the Crash Records Section, Safety Office.

c. The average annual daily traffic can be obtained from the County Roadway Information computer file. For detail analysis, special one-day field traffic counts may be needed.

3.1.4 Determining Statistical Significance

A test should be made to determine the statistical significance of the change in crash experience. Because of the year-to-year variation in crash occurrence due to chance alone, it is entirely possible that a change in number of crashes is due only to chance and not to the safety improvement project. However, as the difference between the number of before and after crashes increases, the probability that this difference is a chance occurrence decreases.

The Poisson curves in Figure 3 can be used to determine if the percent change for before and after crashes is significant, i.e., the change was not due to random variation. The expected crash frequency (E_f) is for one year. The percent change in crashes must fall on or above the curve to be significant at the level chosen. The interpretation of the results is directly dependent on the before crash frequency. Unless adjusted, the before number of crashes per year (B_{PF}) is equal to the expected crash frequency (E_f). The percent change becomes:

$$\text{Percent Change} = (B_{PF} - A_{PF})\ 100/B_{PF}$$

Where:

$B_{PF} = E_f$
B_{PF} = average number of crashes per year before improvement
E_f = expected crash frequency without improvement
A_{PF} = actual average number of crashes per year after improvement

For example, if expected crash frequency was 25 and percent change was 35, the intersecting point falls between the 95 percent and 99 percent curves. For this project, it can be concluded with a 95 percent confidence level, that the reduction in crash frequency during the study period was a result of the safety project. If the percent was 50, the confidence would be 99 percent.

Although the Poisson curves shown in Figure 3 are used to determine if an crash reduction is significant, the curves can also be used to determine if crash increases are significant.

The Poisson curves show that the percent change required to achieve statistical significance increases with a decreasing number of crashes. This limits the practical use of this technique to locations with crash frequencies greater than five crashes. If the observed frequency at the site is low, the percentage change in crashes must be very large to be significant. An assumption of this Poisson test is that the frequency used is the "true" mean of the crash experience at the project site.

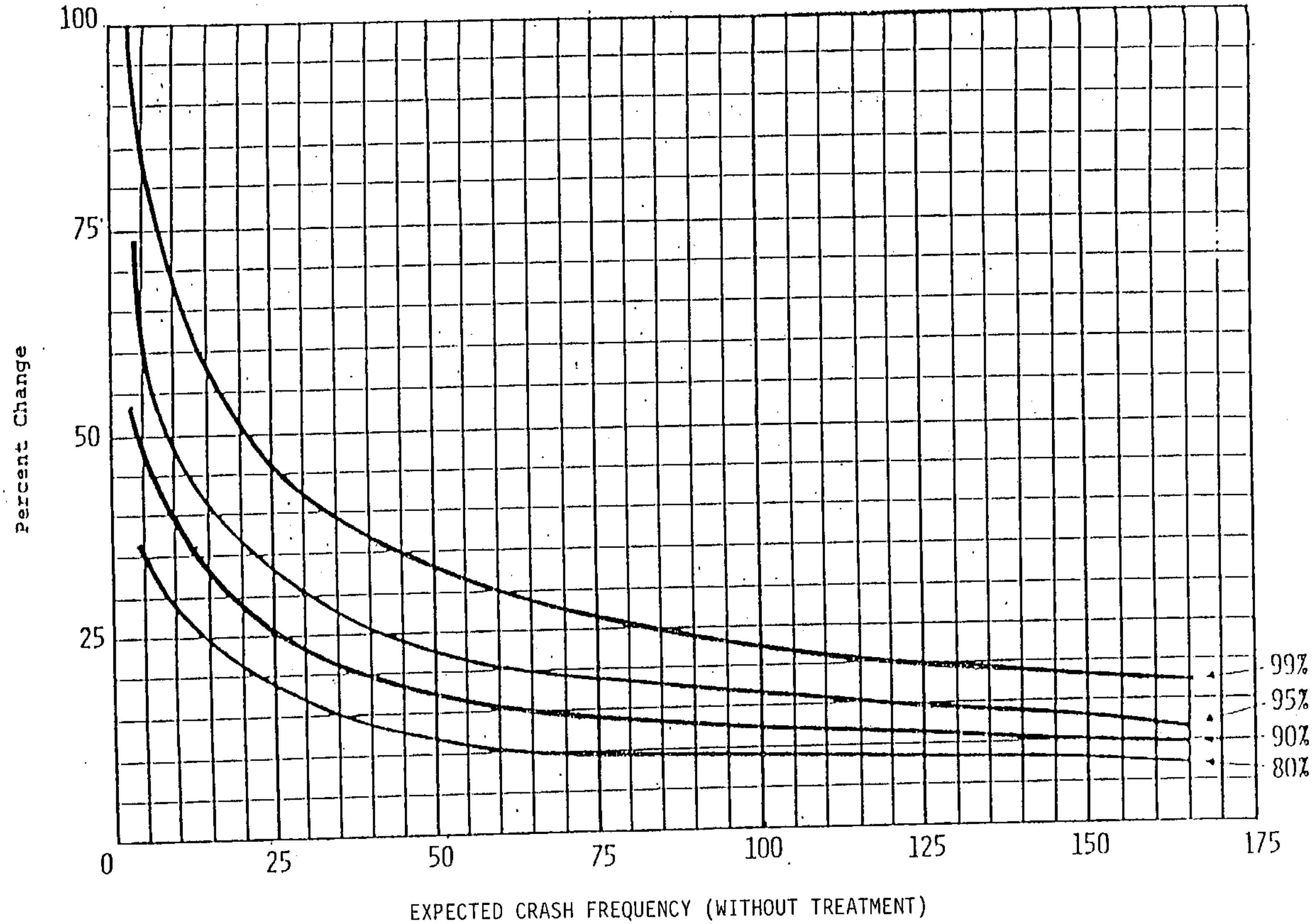


Figure 3. Poisson Curves.

There are several factors that must be recognized and overcome in the evaluation of highway safety projects. They include (ref. 18):

a. Changes in the number of crashes caused by factors other than the improvement project. For example, the initiation of a selective law enforcement program at one or more high crash intersections during the after evaluation period may affect the crash experience and mask the effectiveness of the project.

b. Unidentified trends in the crash rates over time ("Maturation"). For example, a comparison of total crash rates before and after project implementation may show a large decrease in the total crash rate. This may be a result of the project, or it may be that the decrease is an extension of a long-term decreasing trend in total crash rates at the project sites.

c. Regression to the mean. Regression-to-the-mean is a phenomenon that may result when sites are selected on the basis of extreme values, i.e., high crash experience. Regression is the tendency of a response variable, such as crashes, to fluctuate about the true mean value.

d. Random data fluctuations (instability). Crash data is particularly subject to random variations when measured over time, or at a smaller number of locations.

3.2 BEFORE AND AFTER EVALUATIONS

All Highway Safety Improvement Program projects, as well as other significant projects designated as safety improvements, will receive a Before and After Evaluation. The results of these evaluations are required to be reported each year in the Department's "Title II Safety Improvement Program - Annual Report (ref. 13)." The duration of the evaluation includes crash histories for three years prior to construction and three years after construction. The year construction occurred is not included in the evaluation. The project is first evaluated when one year of data is available. Reports are continued for the following years. The data evaluated includes the number of crashes, crash severity, adjustment for traffic, and a statistical test for significance. For skid overlay projects, roadside object elimination, or mitigation projects, only types of crashes that are appropriate are evaluated, i.e., wet weather crashes for the skid overlay projects. The crash severity classes are fatality, injury and property damage only. These classes of crashes are discussed in paragraph 1.2.

Each evaluation not only examines the project's effect on crash reduction, but also on the reduction in crash severity. However, due to the infrequency of fatal crashes, the fatal and injury crashes are often combined. The number of crashes for the after period is adjusted for the change in traffic count. For projects involving highway sections, million vehicle miles are utilized; whereas for spot projects, million vehicles are utilized. In these evaluations, the traffic count only includes the number of vehicles on the highway being improved. It does not include cross traffic.

3.2.1 Crash Rate Calculations

With rare exception, the method of evaluation used for these projects is the comparison of crash rates before, and crash rates after, the completion of the project. Actually, the crash rate is just an adjustment of the number of crashes for the variance in traffic counts. The basic assumption is that without the improvement the crash level would be the same as long as traffic counts remained the same. This concept is shown in Figure 4. As can be seen, the difference between the actual number of crashes and the expected number of crashes provides the effectiveness of the project. It is more accurate to adjust the "expected" crashes for any before and after variation in traffic counts as expressed mathematically in the following formula:

$$E_f = B_{PF}(A_{TE}/B_{TE})$$

E_f = expected crash frequency at the project site without improvement
A_{TE} = average annual daily traffic after improvement
B_{TE} = average annual daily traffic before improvement
B_{PF} = average number of annual crashes before improvement

The average traffic count or crashes is the sum of each year in the study period (before and after kept separate), divided by the number of years in the study.

The cross street traffic at intersections is not examined for these basic evaluations.

Percent change in crash frequency is then computed by the following equation:

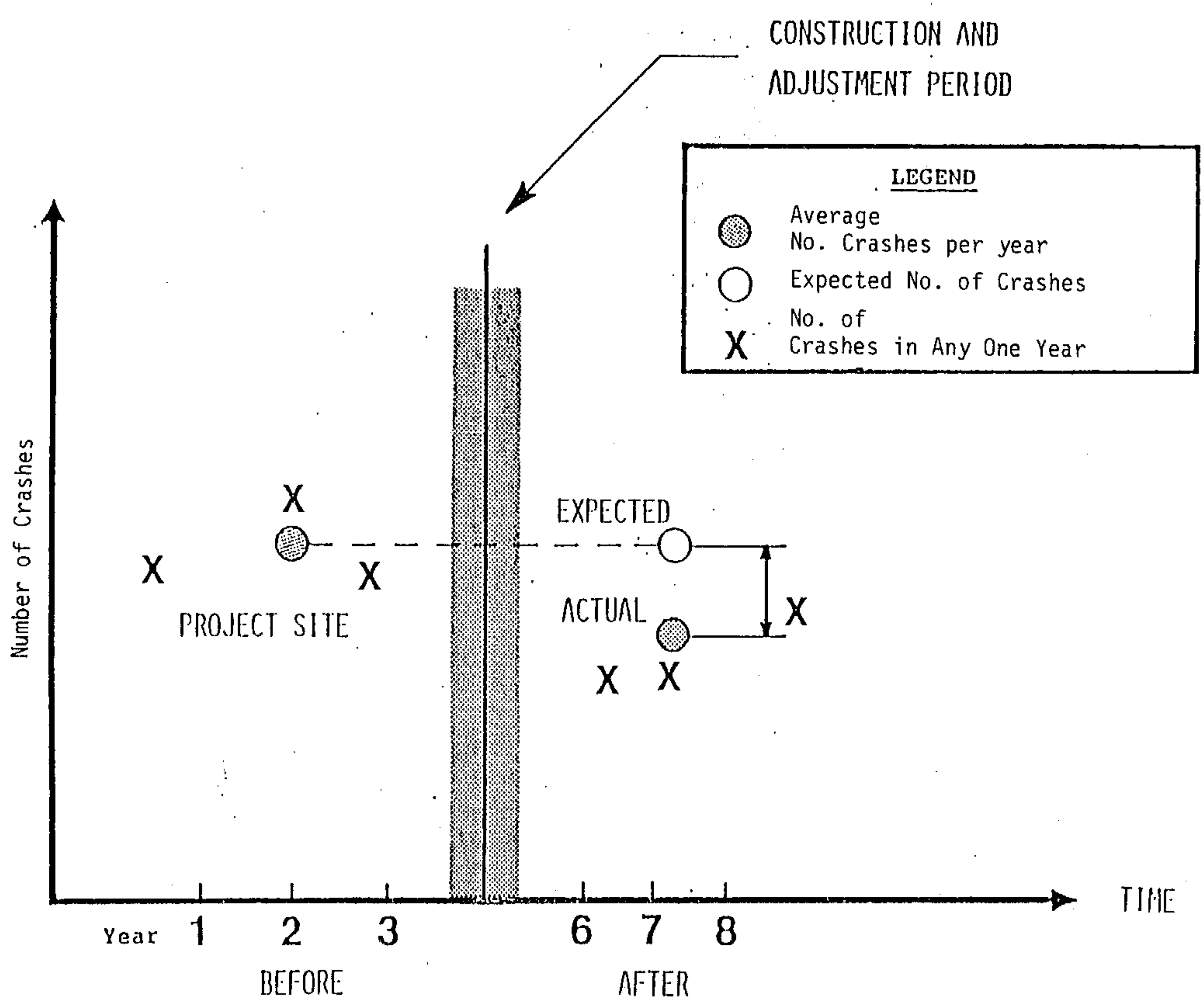
$$\text{Percent Change} = (E_f - A_{PF})\ 100/E_f$$

Where:

E_f = expected crash frequency at the project site without improvement

A_{PF} = actual average number of crashes per year after improvement

Figure 4. Before and After Evaluations



The value for the expected crash frequency (E_f), and its percent change, describes the effectiveness of the project and is used as direct input to the statistical testing.

The calculations can also be made for crash severity or type of crashes. When using types of crash, the traffic count should be examined to determine if it is still applicable, e.g., night vs. day.

3.2.2 Significance Test

The statistical test for significance is based on the hypothesis that project improvement had no effect on the crash level. In other words, the crash level prior to the improvement will remain the same after the improvement. The curves in Figure 5 are for the 95 percent confidence level and should be used for those safety improvement projects using Highway Safety Improvement Program funds. A 90 percent confidence level would not be unreasonable and should be used for other safety improvement projects.

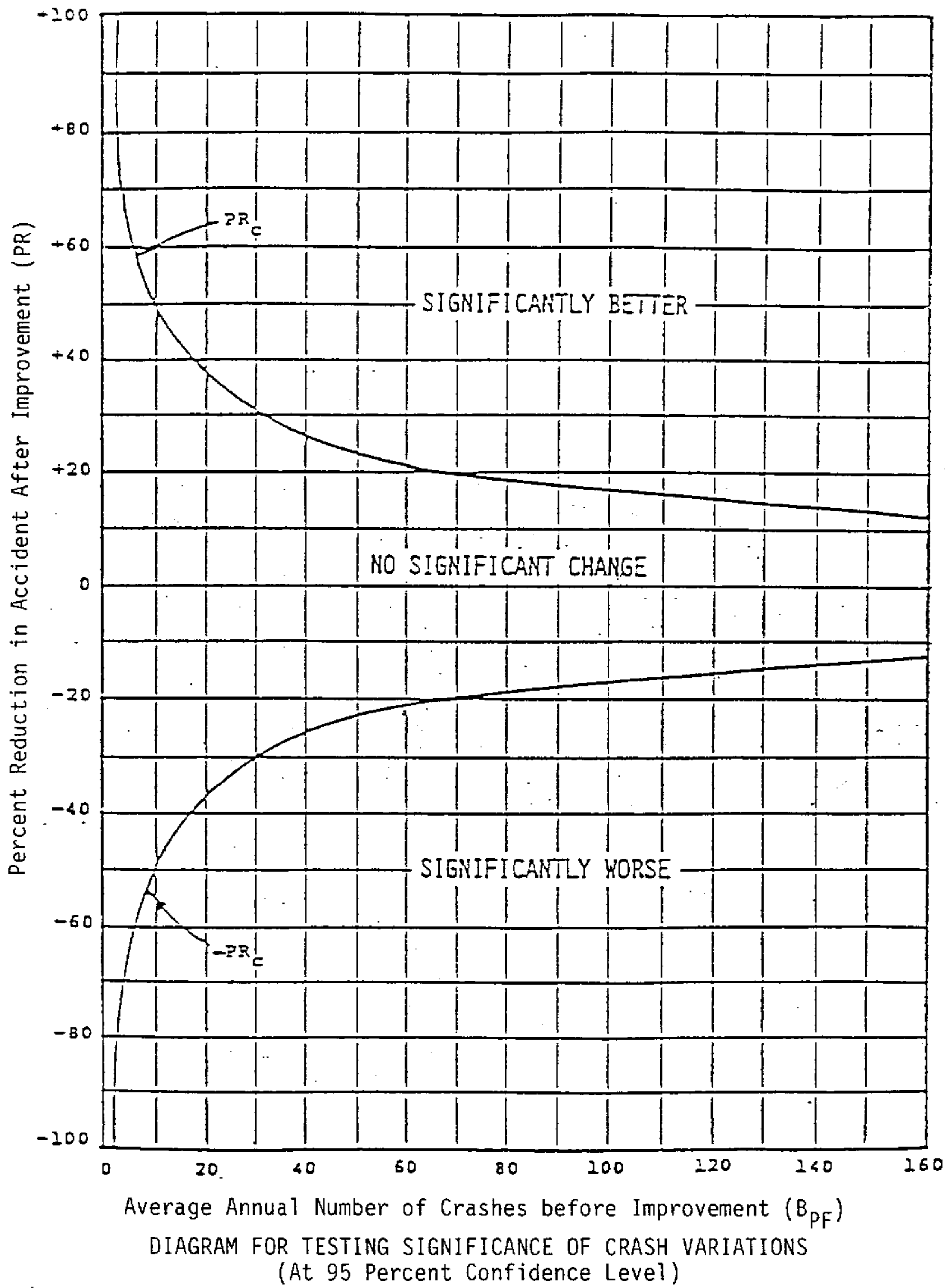


Figure 5. Diagram for Testing Significance of Crash Variations.

Referring to Figure 5, if the actual percent reduction (PR) is greater than the 95 percent Poisson curve shown as PR_c (above the top curve), then the reduction is significant at the specified confidence level. In this case, the improvement can be considered a success. If PR is less than PR_c (between the curves), but greater than zero, the apparent improvement is probably due to chance. If PR is negative (meaning an increase in crashes), but greater (less negative) than the $-PR_c$ curve, the increase is probably due to chance. However, if PR is more negative than the $-PR_c$ curve, the situation has become significantly worse as a result of the improvement. The conditions are summarized below (Ref. 19):

Condition	Changes in Crash Occurrence
$PR > PR_c$	Significantly better
$-PR_c \le PR \le PR_c$	No significant change
$-PR_c > -PR$	Significantly worse

For aggregate project evaluations, the statistical test for significance will be the chi-squared, which is used to test discrete variables. The hypothesis is that discrete variables are independent. Use a 90 percent confidence level. The frequency cell method is employed. Fortunately, this can all be accomplished by a computer program. Both the chi-squared, X^2, value and the critical chi-squared value are obtained from statistical tables for the selected confidence level. The row number is generally two, before and after. The column contains the number of the sites. For the data to be significant, the calculated chi-squared must be greater than that value found in the T-Distribution Table, which is included as Appendix O).

In the tables, the degrees of freedom are the number of comparisons or number of projects, minus one. Not all group type projects will be evaluated for significance.

3.3 DETAIL EVALUATIONS

The object of the detail evaluation is to determine if there was a significant reduction in crashes, if there were changes in crash types, and the external factors that cause the crash changes.

3.3.1 Project Selection

Each District Safety Engineer may elect to perform detail evaluation of one or more projects per year. As a guideline, each project should meet the following criteria:

a. Funded by the Highway Safety Improvement Program

b. Have a benefit-cost ratio above one

c. Be in the Work Program and scheduled for letting within an 18-month period. A completed project can also be evaluated.

d. One or more control sites can be established

e. Probability that crash reductions will be significant

As discussed in paragraph 3.2.2, the lower the annual number of crashes, the higher the crash reduction percentage must be in order for the reduction to be significant. The following calculations can determine if a project will be significant:

a. Determine the percent of crashes that is expected to be reduced (PR). This percentage should be lower than that shown on the benefit-cost; it can not be higher

b. Multiply the average number of annual crashes (A_a) times the PR/100. This is the number of crashes that are expected to be reduced (R_{AP})

c. Calculate the standard deviation for annual crashes for the past three years (five or six years is more accurate). Appendix P shows how to calculate standard deviation(0)

d. Calculate the number of crashes needed (N_s) for the project to be significant using the following formula:

$$N_s = A_a\left(\frac{0}{R_{AP}}\right)^2$$

Where:

N_s	=	the number (sample size) of crashes needed
A_a	=	average annual number of crashes
0	=	standard deviation of annual number of crashes
R_{AP}	=	number of crashes expected to be reduced

For a project to be effective, N_s should be approximately equal to A_a.

Project limits are to be established as discussed in paragraph 3.1.2.

3.3.2 Selection of Control Sites

This plan compares the percent change in crashes at the project site with the percent change in crashes at similar site(s) without the improvement (control sites) for the same time period. An assumption is made that the test site, in the absence of the improvement, exhibits crash experience similar to the control sites. Any difference between the crash experience at the project and control site is attributable to the project.

The Before and After Evaluation with control sites is considered the most desirable plan for highway safety project evaluation because evaluations are based on the assumption of a cause and effect relationship between project countermeasures and a change in the crashes. The use of control sites allows the engineer to reduce the influence of other variables on study results. Also, it may be desirable to control for specific independent variables, such as climatic conditions, law enforcement, speed, or pavement conditions.

Generally, it is not too difficult to identify sites that have similar geometrics. However, the crash experience at any site reflects the interaction of the driver, the roadway, and the environment. An attempt should be made to select sites in which all three of these factors are similar to those of the project site. Recognizing that it may be difficult to find sites that are absolutely identical for these three factors, a trade-off must be made between the statistical desirability of using a control site experimental plan, and the possible inaccuracies introduced by dissimilarities between the project and control sites. This loss of accuracy can be minimized by careful selection of variables that differ between the project and control sites.

The control sites should exhibit crash patterns similar to the project site. Since the crash and severity can be similar at two or more different sites due to change, variables such as horizontal and vertical alignment, number of lanes (including turn lanes), pavement width, type of traffic control devices, lane use, access control, and traffic volume, should be similar. In addition to these considerations, identify key variables that must be controlled in the evaluation. The key variables are independent variables that are expected to influence the effectiveness of a specific project. For example, suppose a skid overlay project is to be evaluated using a control site. Both speed and the pavement surface conditions before the improvement may influence crashes. The control site selection process should, therefore, consider speed and type of pavement as key variables.

The matching of other independent variables adds to the desirability and validity of the control sites. As a guide, it is recommended that up to a 10 percent variation in any key variable between the project and control sites be considered acceptable. The use of a 10 percent variation is not based on a quantitative analysis of the control site selection process, but is provided as a guide.

For evaluation studies of projects implemented at an earlier point in time, control sites can be identified by searching and analyzing historical crash and location data at sites similar to the project site. However, if the evaluation study is being planned prior to project implementation, caution must be exercised in the selection of control sites. Since the control site should be similar to the project site without the improvement, a question may arise regarding potential danger of improving one site based on an identified deficiency and not improving a second site or sites with a similar deficiency.

It may not always be possible for district personnel to select applicable control sites; therefore, this requirement (condition d, in paragraph 3.3.1) may be omitted.

3.3.3 Data Collection

This step involves determining the type of data to be collected, data reduction activities, data stratifications, and other information needed to develop an evaluation plan. It is important that data requirements be established and recorded before data collection activities are undertaken to avoid any failure to collect critical data. For future projects, it may be possible to obtain certain "before" data following project implementation. Evaluation data requirements depend on the following criteria:

a. Objectives of the evaluation

b. Anticipated impacts from the environment surrounding the project site

c. Anticipated impacts (other than the objectives) on the environment resulting from the project

d. Project cost, including implementation, operating, and maintenance cost

Items two and three require judgment based on experience. In these two items, impacts that may affect the project's effectiveness, as well as impacts that may result from the project (other than those being evaluated as a purpose or objective) must be anticipated. These impacts are to be included in the evaluation objective statement as well.

Operational data (such as vehicle speed, turning movements, or travel time and delay) or other non-crash data may also be required for control site selection. Use standard data collection procedures for the collection of this data. Also, appropriate data collection equipment should be utilized. The Department's "Manual on Uniform Traffic Studies" (ref. 12) should be used for data collection procedures.

A critical factor to consider in the data collection process is the delineation of project limits. The boundary of the project site should include only that area influenced by the countermeasures. Evaluation data collected outside the area of influence may seriously affect the outcome of the evaluation. Control site limits should closely match those established for the project site. Establish project limits as discussed in paragraphs 2.1.4. and 3.1.2.

The entire crash data base for a project site should be tabulated annually by crash type, severity, time of day, surface and weather conditions, driver action, etc.

Identify the type of exposure data (traffic counts) that is needed. Determine if this data is routinely being collected; if not, make arrangements to obtain the needed traffic counts. Problems associated with exposure data must also be recognized. Because exposure data must be taken during the same period that the crash data is acquired, the use of existing volume data creates a problem in defining crash rates for wet weather crashes and night or day crashes.

Exposure data may also include conflicts and/or conflict generators, such as driveways (especially commercial). Conflict points should always be identified and tabulated. If a project evaluation is needed prior to the time period needed to accumulate sufficient crash data, an engineering conflict analysis should be conducted.

Another problem with using exposure is that it is often derived from historic traffic count surveys. The use of these data sources may grossly under or over-estimate the exposure at a specific site. Bias association with data collection techniques may also result from obtaining non-random samples, which do not represent the "true" volume situation.

Once all data needs are identified:

a. List all data variables associated with the objectives of the evaluation

b. List data needs for control site selection, if necessary

c. Estimate variables expected to be impacted either negatively or positively by the highway safety project

d. Estimate sample size requirements to the extent possible for data needed. List all data needs and magnitudes for inclusion in the evaluation plan and develop the complete evaluation plan

3.3.4 Crash Rate Calculations

The crash rates are to be calculated as discussed in paragraph 3.2.1. This assumes that without improvement the crash level will remain the same each year. Adjusting for traffic variations, the expected crash frequency rate is:

$$E_f = B_{PF}(A_{TE}/B_{TE})$$

An exception to this formula is when crash data for the before period exhibits a trend. This observation can be tested through the use of linear regression. If this technique is used, the first assumption is modified to: without the introduction of the highway safety improvement, the number of crashes will continue to increase (or decrease) at the same rate that it has been increasing (or decreasing) in the before period. Linear regression is a technique for expressing a linear (straight-line) functional relationship between related variables. Correlation is used to express the precision with which the value of one variable can be predicted if the value of an associated variable is known.

The least square regression technique is recommended for an analysis of the crash trend. In this technique, the number of crashes for each year (Y_i) is plotted against time (X_i), where i represents the number of years from the beginning of the evaluation period. The equation of the line that "best fits" the trend in the crashes is then given by:

$$Y_i = \bar{Y} + b(X_i - \bar{X})$$

Where:

Y_i = the estimated value of the number of crashes in year i

$\bar{Y}$ = the average value of the number of crashes over the entire evaluation period

X_i = the year for which the estimate is desired

$\bar{X}$ = the mid-point of the evaluation period

b = the regression coefficient (i.e., slope of the regression line)

The regression coefficient (slope of the regression line) is obtained by:

$$b = \frac{\sum_{i=1}^{N} (X_i - \bar{X})(Y_i - \bar{Y})}{\sum_{i=1}^{N} (X_i - \bar{X})^2} = \frac{S_{xy}}{S_{xx}}$$

Where:

$(X_i - \bar{X})$ = the value of the difference between each year and the mid-point of the evaluation period (mid-point of the before plus after period)

$(Y_i - \bar{Y})$ = the value of the difference between the number of crashes per year and the average number of crashes during the entire analysis period

N = the number of years used in the analysis period

Since the regression technique is designed to test the strength of the relationship between the crashes and time, time periods greater than three years yield more reliable results. Therefore, the maximum number of years for which crash data are available should be used.

Two tests should be performed to determine whether the indicated trend is significant, or is due to random variations in the data. The first test should be an evaluation of the correlation coefficient (r). The square of this coefficient is a measure of the ability of independent variable (time) to explain the variation in the dependent variable (crashes). As a general rule, if the value of r^2 is greater than 0.8, then use of the regression results should be considered. If r^2 is less than 0.8, then the average should be used as described previously.

The correlation coefficient can be calculated as:

$$r = \frac{S_{xy}}{\sqrt{S_{xx}S_{yy}}}$$

The second test is a determination of the significance of the regression coefficient (b). This test is used to determine whether the slope of the line is significantly different than zero. The equation for this test is:

$$t = \frac{b}{S_e}\sqrt{\frac{S_{xx}}{n}}$$

Both r and t are obtained through standard statistical programs on the computer or calculators.

The value of "t" obtained is to exceed the values in the t-distribution tables (Appendix O). If the two tests are met, the regression equation should be used to obtain E_f, expected frequency of crashes.

The expected number of crashes and the present reduction in crashes can be calculated by:

$$E_i = \bar{Y} + b(X_i - \bar{X})$$

Where:

E_i = expected number of crashes at the project site for time period i, if no improvement has been made

X_i = years since the beginning of the analysis period

The E_i still can be adjusted for traffic count fluctuations by:

$$E_f = E_i(A_{TE}/B_{TE})$$

The percent change is then calculated as follows:

$$\text{Percent Change} = (E_f - A_{PF})\,100/E_f$$

Where:

E_f = expected crash frequency at the project site without improvement

A_{PF} = the observed average number of crashes per year at the project site after the improvement

3.3.5 Significance Test

Statistical tests for significance were discussed in paragraph 3.2.2. For these Detail Evaluations, the confidence level should be 95 percent. Therefore, the Poisson curve in Figure 5 is appropriate.

3.3.6 Economic Analysis

This cost-effectiveness analysis is to be conducted only on projects that are statistically significant at the selected level of confidence. The cost-effectiveness of a project based on a chance reduction in an crash category does not provide usable information on the effectiveness of the project.

The existing benefit-cost analysis and updating data will be used as the basis for the cost-effectiveness analysis. The benefit-cost ratio is the ratio of the benefits accrued from observed crash and/or severity reduction, to costs of implementing, operating and maintaining the project. The ratio of equivalent uniform annual benefits to costs is used to determine the benefit-cost ratio. Any project that has a benefit-cost ratio greater than 1.0 yielded more dollar-value benefits than the cost of the project.

Project costs, including all engineering phases, are to be obtained from the project record system (WPA). Service life of improvements are: geometric changes - 20 years; skid overlays - 8 years; traffic signals - 15 years; structures - 50 years. Use the service life that best fits the overall improvement project. Construction item costs are not readily available, and therefore, will not be used. The calculations are based on annual cost. The interest factor used to obtain equivalent annual costs is 7 percent per "FDOT Life Cycle Cost Analysis" (ref. 25). Capital Recovery Factors for this interest are shown in Appendix L, Interest Factors for Annual Compounding Interest (7%).

Add or subtract the effect of the improvements on the annual maintenance cost (change in maintenance). Some improvements, such as traffic signals, increase the maintenance cost. Improvements like shoulder paving decrease maintenance cost. This data may be obtained from the Bureau of Maintenance.

Operation costs and vehicle travel will not be used. The only benefits used are for crash reductions. The cost figures for crashes will be provided by the Safety Office. For a detailed discussion on the preparation of benefit-cost analysis refer to paragraph 2.1.5.

3.3.7 Evaluation Documentation

Prepare comments on the following and include with a project folder (these comments will generally be included in the "Title II Safety Improvement Program - Annual Report" (ref. 13)):

a. Did the project accomplish the purpose for which it was intended?

b. Were the evaluation objectives accomplished?

c. To what degree were the evaluation objectives accomplished?

d. Did the study reveal any unexpected results, or results that were contrary to the project purposes?

The evaluation should emphasize the type of crashes reduced as well as overall reduction, taking into consideration the following:

a. Were the type of crashes reduced those that were expected to be reduced?

b. Was the percent reduction lower or higher than expected?

Also include any recommendations for future study.

3.4 PROGRAM EVALUATIONS

The objective of program evaluations is to provide guidelines for assessing the value of a completed or ongoing highway safety program. The measures of program effectiveness are observed changes in the number, rate, and severity of traffic crashes resulting from the implementation of the program. Program effectiveness is also examined with respect to the benefits derived from the program, considering the cost of implementing the program.

The methodology described in the following paragraphs for evaluation of rail-highway grade crossing improvement (signal) projects is the procedure for program evaluations. Projects are grouped by total program for evaluation but are also grouped for various subjects including types of signals. The objective is to determine what types of projects are the most effective. This method also evaluates the criteria for the selection of the type of signal because each type of signal is equally effective and the criteria for their selection is equally effective.

The first activity in Program Evaluation is to determine the highway safety goal to be evaluated. The goal must be stated in a brief but concise statement in accordance with the following criteria:

a. The program scope as defined by the type(s) of crashes and/or severity measures that are expected to be affected by the program. These measures should be specific to the program but general enough to be appropriate for all possible projects within the program.

b. The program objective defined should always be the improvement of safety (operational improvement and maintenance may be a secondary goal of the program but not the primary goal).

c. The location type(s) included in the program (intersections, curves, tangents, or combinations of location type(s).

d. The geographic program area affected by the program activities (city, state, county, road class, etc.).

Program evaluations are to be conducted by the Safety Office for hazard elimination projects that have previously been evaluated as a Detail Evaluation described in paragraph 3.3. The objective of these evaluations is to discover what type of improvements are most cost-effective. The test for significance for these projects, grouped by type of improvement, will be the chi-squared test described in paragraph 3.2.2.

The Department uses standard crash reduction factors. Program evaluations will be used to update these factors. The results of program and project evaluations are disseminated to District personnel. Program evaluations of significant impact will be forwarded to appropriate administrative personnel.

3.4.1 Evaluation of the Rail-Highway Grade Crossing Improvement Program

In evaluating the effectiveness of the Rail-Highway Grade Crossing Improvement Program, only train-vehicle collisions are utilized. Due to the low number of these crashes, the aggregate Project Evaluation method is the most applicable. Since all this data is on a computer program, it is convenient to utilize statistical program packages in the evaluation. Projects are grouped by the following type improvements:

a. Roadside flashing lights - replacing passive warning signs

b. Cantilevered flashing lights - replacing passive warning signs

c. Roadside flashing lights and gates - replacing passive warning signs

d. Cantilevered flashing lights and gates - replacing passive warning signs

e. Gates added to any type of flashing light signal

f. Cantilevered flashing lights - replacing roadside flashing lights

The replacement or updating of one signal system with the same or similar system is not utilized in the evaluation. Although replacing an older railroad grade crossing traffic signal with a new system improves the visibility of the system due to an increase in light output and lens size, this type of project is rarely accomplished utilizing safety funds.

The evaluation is also conducted on the type of funds that were utilized for the improvement project. The funds include Rail-Highway Safety Funds (138 and 139), Federal Aid Construction Funds, State Funds, Railroad Funds and special project Amtrak Funds. The reason that projects are partitioned into funding categories, as well as by type of improvements, is that project selection methods vary as to funding category.

3.4.1.1 Data Collection

A six-year study base is utilized for the evaluation. That is, six years of crash history prior to the improvement project and six years of crash history after the improvement project. Again, the calendar year that the project was completed is not included in the evaluation. Evaluations begin the first year that the crash history is available, and continue for five consecutive years. This not only provides a significant crash data, but also provides the opportunity to determine if there is a novelty effect for signal improvements. The installation of a shiny new system in itself has psychological effect on the driver who becomes more cautious during an initial period after improvement. The six-year study period may also provide data as to the effect of declining light output on driver behavior. The declining light output may be due to normal equipment deterioration (life) or inadequate maintenance.

3.4.1.2 Crash Rate Calculations

Since train-vehicle collision evaluations must use an aggregate number of improvement projects to provide meaningful data, the crash rate is expressed as number of crashes per crossing year. Since this figure is dependent upon the number of crossings, as well as the number of years, the crash rate must always be a product of the sum of these numbers and not an average of groups of crossings. Thus:

$$\text{Crash Rate} = (\text{Sum } (A_{x1}+A_{x2}\ldots A_{xn})y_1+(A_{x1} + A_{x2}\ldots A_{xn})y_2 + (A_{x1} + A_{x2}\ldots A_{xn})y_n)/(X_n)(y_n)$$

Where:

A_{xy} = number of crashes at crossing x for year y
x_n = total number of crossings projects
y_n = total number of before years (or after) in study

As discussed in paragraph 3.2.1, it is assumed that without the improvement the before crash rate would have continued each year. Again, the expected crash frequency is adjusted for highway traffic. Thus:

$$E_T = B_{TF}(A_{TT}/B_{TT})$$

Where:

E_T = expected number of crashes per crossing year for a partitioned group of crossings without the improved signals
B_{TF} = actual number of crashes per crossing year for that group of crossings before improved signals were installed
A_{TT} = average number of highway vehicles per day, at all crossings in group, after improvement
B_{TT} = average number of vehicles per day, at all crossings, before improvement

The percent change is then calculated as follows:

$$\text{Percent Change} = (E_T - A_{TF}) - 100/E_T$$

Where:

E_T = expected number of crashes per crossing year for partitioned group of improvements without improved signals
A_{TF} = observed average number of crashes per crossing year for partitioned group of improvements after signals installed

3.4.1.3 Significance Test

Although it appears the chi-squared test for significance would be more appropriate, a sufficient number of crashes (5) do not occur at each crossing (cell) to make the test valid. Therefore, the significance test will be using the Poisson curve in Figure 3. This curve is at the 95 percent confidence level, which is appropriate.

The y coordinate, percent change, is the figure calculated in paragraph 3.1.4. The x coordinate is E_T, expected number of crashes per crossing year, multiplied by the number of crossings in the evaluation group x. This, E_T times X_n becomes the number of expected crashes. As explained in paragraph 3.2.2, if the point, PR, falls above the upper curve, then the data is significant. If it falls below the upper curve, the change in crashes is probably due to chance, etc.

3.4.1.4. Economic Analysis

The economic analysis is based on the cost of reducing one crash. In 1988 for every 10 train-vehicle collisions there were approximately 5 injuries and one fatality. It is not believed that crash severity is a variable. Using the FHWA recommended cost per crash figures for injury, property and fatality cost, the benefit derived by reducing a train-vehicle collision in 1988 was approximately $154,500.

Cost will be calculated on an annual basis. The capital cost is the cost the railroad companies charge plus any additional work (such as intersection traffic signal installation that was let to contract). Work performed by county or utility company forces and not charged to the program is not included. The life of signals is 15 years with negligible salvage value. Cost of money is 7 percent per "FDOT Life Cycle Cost Analysis" (ref. 25); thus, the Capital Recovery Factor (CRF) for signal work is 0.1098. Annual cost is calculated as:

$$C_A = C_S \,.0.1098 + C_n \cdot CRF_7 + M$$

Where:

C_A = annual costs of crossing improvements
C_S = cost of railroad traffic signal installations
C_n = cost of other improvements (service life may differ)
M = annual change in maintenance cost of warning devices (signals)

The change in maintenance cost will be $800 for flashing lights and $1,200 for flashing lights and gates. If gates are added to flashing lights, the change in maintenance cost is $400.

The cost effectiveness will be calculated for groups of crossings being evaluated. The cost effectiveness is calculated:

$$CE = \text{Sum}\ (C_{AN})/(E_T - A_{TF})\ x_n$$

Where:

C_E = cost per crash reduced
C_{AN} = sum of the annual cost of each of the crossings in the improvement group
E_T = expected number of crashes per crossing year for the improvement group without improved signals
A_{TF} = observed average number of crashes per crossing year after signals installed for the improvement group
x_n = number of crossings in improvement group

In order to more accurately compare cost-effectiveness, the year of the improvement should be considered. Improvements in 1980 will cost more than the same improvements made in 1975. Thus annual cost becomes:

$$C_A = \text{Sum}\ (C_S \cdot 0.1098)\ I_f + \text{Sum}\ (C_n \cdot CRF_7)\ I_f + \text{Sum}\ (M)$$

Where:

I_f = the inflation factor for the number of years since the improvements were installed

As an estimate, the Compound Amount (CF) of 7 percent could be used for I_f. Therefore, the I_f from 1975 to 1980 would be 1.403.

3.5 FOLLOW-UP

Any improvement project location where there has been a significant crash increase must be field investigated. The review team should repeat the same steps described in paragraph 2.1. The engineers should determine if roadway deficiencies are contributing to the problem and if any of these deficiencies were related to the improvements. Correction of identified deficiencies should be scheduled as soon as possible. Do not defer improvements because of the evaluation period.

BIBLIOGRAPHY

1. Standard Method of Test for Skid Resistance of Paved Surfaces Using A Full Scale Tire. ASTM, E274-70.

2. National Rail-Highway Crossing Inventory Procedure Manual. U.S. Department of Transportation and Association of American Railroads, 1973.

3. National Railroad-Highway Crossing Inventory Update Manual. U.S. Department of Transportation, January 1976.

4. Uniform Vehicle Code.

5. Evaluation of Criteria for Safety Improvements on Highways. Jorgensen, Roy and Associates. Westat Research Analysis, Inc., 1966.

6. Highway Design and Operational Practices Related to Highway Safety. AASHTO, Washington, D.C., 1974.

7. Roadside Design Guide. AASHTO, Washington, D.C., 1988.

8. Design Criteria Related to Highway Safety. Index 700, Roadway and Traffic Design Standards, Florida Department of Transportation, Tallahassee.

9. A User's Guide to Positive Guidance. U.S. Department of Transportation, Federal Highway Administration, Washington, D.C., June 1977.

10. Functional Requirements of Highway Safety Features. U.S. Department of Transportation, FHWA-TS-81-216, December 1981.

11. Influencing Factors For Rail-Highway Grade Crossing in Florida. Florida State University, Tallahassee, Florida, Contract #73-A27.

12. Manual on Uniform Traffic Studies. Florida Department of Transportation, Tallahassee, Florida.

13. Title II Safety Program - Annual Report. Florida Department of Transportation, Tallahassee, Florida.

14. Manual on Uniform Traffic Control Devices for Streets and Highways. U.S. Department of Transportation, Federal Highway Administration, Washington, D.C., 1988.

15. Roadway and Traffic Design Standards. Standard Indexes, Florida Department of Transportation, Tallahassee, Florida.

16. An Information Guide for Roadway Lighting. American Association of State Highway and Transportation Officials, Washington, D.C., 1984.

17. American National Standard Practices for Roadway Lighting. Illuminating Engineering Society of North America, New York, New York, 1977.

18. Highway Safety Evaluation Procedural Guide. U.S. Department of Transportation, National Highway Institute (prepared by Goodell-Grivas, Inc.), Washington, D.C., November, 1981.

19. Highway Safety Program Management Manual. Tennessee Department of Transportation, June, 1978.

20. Federal-Aid Highway Program Manual. Volume 8, Chapter 2, Section 3, U.S. Department of Transportation, Washington, D.C.,

21. Highway Safety Improvement Program (HSIP). U.S. Department of Transportation, Federal Highway Administration, Washington, D.C., December 1981.

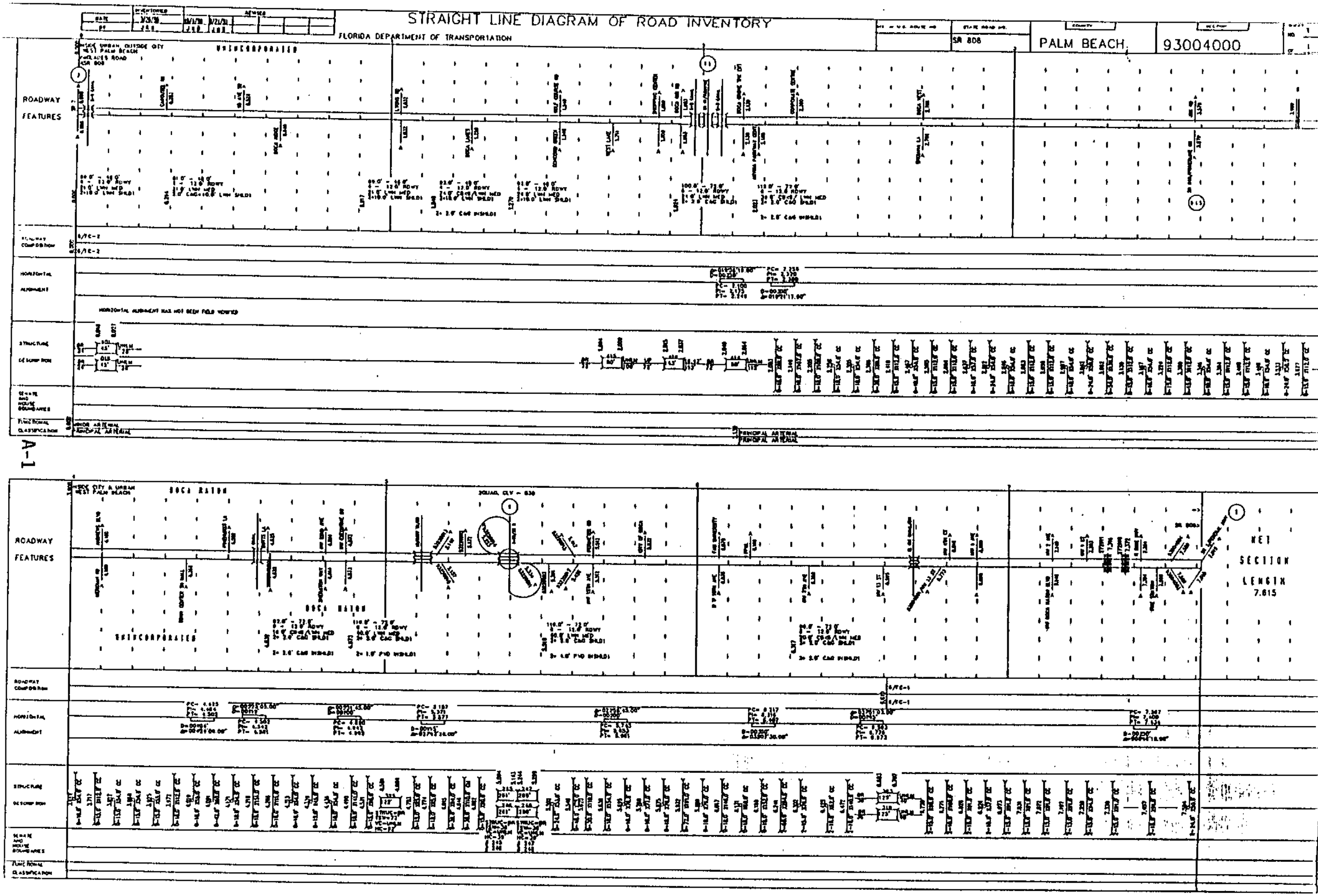
22. Accident Reduction Factors For Use In Calculating Benefit/Cost, Florida Department of Transportation, Safety Office, Tallahassee, Florida, November 1988.

23. Florida's Design Standards for Resurfacing, Restoration, and Rehabilitation (RRR) of Streets and Highways, Florida Department of Transportation, Tallahassee, Florida, 1988.

24. Highway Safety Engineering Studies, Procedural Guide. U.S. Department of Transportation, Federal Highway Administration, Washington, D.C., November 1981.

25. Life Cycle Cost Analysis for Transportation Projects. Florida Department of Transportation, Office of Value Engineering, Tallahassee, Florida, July, 1990.

APPENDICES


STRAIGHT LINE DIAGRAM OF ROAD INVENTORY
FLORIDA DEPARTMENT OF TRANSPORTATION
SR 808
PALM BEACH
93004000
ROADWAY FEATURES
UNINCORPORATED
BOCA RATON
NET SECTION LENGTH 7.815

FLORIDA TRAFFIC CRASH REPORT

MAIL TO: DEPT. OF HIGHWAY SAFETY & MOTOR VEHICLES
TRAFFIC CRASH RECORDS
TALLAHASSEE, FLORIDA 32399-0500

DO NOT WRITE IN THIS SPACE

Time & Location

DATE OF CRASH | TIME OF CRASH ☐ AM ☐ PM | TIME OFFICER NOTIFIED ☐ AM ☐ PM | TIME OFFICER ARRIVED ☐ AM ☐ PM | INVEST. AGENCY REPORT NUMBER | HSMV CRASH REPORT NUMBER

EXAMPLE

COUNTY/CITY CODE | Feet or Miles N S E W ☐ ☐ ☐ ☐ Of | CITY OR TOWN (Check if in City or Town) ☐ | COUNTY

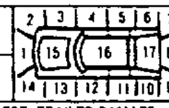
AT NODE NO ______ OR ______ 1☐ 2☐ FEET/MILES | FROM NODE NO ______ | NEXT NODE NO. ON ROAD ______ | NO. OF LANES | 1☐ DIVIDED 2☐ UNDIVIDED | ON STREET, ROAD OR HIGHWAY

AT INTERSECTION OF ______ 1☐ 2☐ OR ______ FEET/MILES ☐N☐S☐E☐W OF INTERSECTION OF

Section 1

DRIVER ACTION 1 Phantom 2 Hit & Run 3 N/A | YEAR | MAKE | TYPE | VEH. LICENSE NUMBER | STATE | VEHICLE IDENTIFICATION NUMBER

TRAILER OR TOWED VEHICLE INFORMATION



POINT OF IMPACT ☐
CIRCLE AREA OF DAMAGE
18 Undercarriage
19 Overturn
20 Windshield
21 Fire 22 Trailer

Vehicle

VEHICLE TRAVELING ☐N☐S☐E☐W ON ______ At ______ Est. MPH | Posted Speed | EST. VEHICLE DAMAGE $ 1 Disabling 2 Functional 3 No Damage ☐ | EST. TRAILER DAMAGE $

INSURANCE CO. (LIABILITY OR PIP) | POLICY NUMBER | VEHICLE REMOVED BY: 1 Tow Rotation List 2 Tow Owner's Request 3 Driver 4 Other ☐

OWNER'S FULL NAME (Check if Driver ☐) | CURRENT ADDRESS (Number and Street) | CITY AND STATE | ZIP CODE

OWNER'S FULL NAME (Trailer or Towed Vehicle) | CURRENT ADDRESS (Number and Street) | CITY AND STATE | ZIP CODE

DRIVER (Exactly as on Driver's License)/Pedestrian | CURRENT ADDRESS (Number and Street) | CITY AND STATE | ZIP CODE | DATE OF BIRTH

DRIVER'S LICENSE NUMBER | STATE | LIC. TYPE | BAC TEST 1 Blood 2 Breath 3 Urine 4 Refused 5 None ☐ | RESULTS . % | ALC/DRUG | PHYS. DEF. | RES | RACE | SEX | INJ. | S. EQUIP. | EJECT.

Pedestrian

HAZARDOUS MATERIALS BEING TRANSPORTED 1 None 2 Flammable Liquid 3 Explosives 4 Poisonous Gas 5 Corrosive Materials 6 Radioactive Materials 7 Other ☐ | Driving Ability Questionable RECOMMEND RE-EXAM 1 YES 2 NO 3 NOT APPLICABLE If YES, Explain in Narrative ☐ | Driver's Phone No. ( )

# PASSENGER'S NAME	CURRENT ADDRESS	CITY & STATE/ZIP CODE	AGE	LOC	INJ.	S. EQUIP.	EJECT.
1.							
# PASSENGER'S NAME 2.	CURRENT ADDRESS	CITY & STATE/ZIP CODE					
# PASSENGER'S NAME 3.	CURRENT ADDRESS	CITY & STATE/ZIP CODE					

Section 2

DRIVER ACTION 1 Phantom 2 Hit & Run 3 N/A | YEAR | MAKE | TYPE | VEH. LICENSE NUMBER | STATE | VEHICLE IDENTIFICATION NUMBER

TRAILER OR TOWED VEHICLE INFORMATION

POINT OF IMPACT ☐
CIRCLE AREA OF DAMAGE
18 Undercarriage
19 Overturn
20 Windshield
21 Fire 22 Trailer

Vehicle

VEHICLE TRAVELING ☐N☐S☐E☐W ON ______ At ______ Est. MPH | Posted Speed | EST. VEHICLE DAMAGE $ 1 Disabling 2 Functional 3 No Damage ☐ | EST. TRAILER DAMAGE $

INSURANCE CO. (LIABILITY OR PIP) | POLICY NUMBER | VEHICLE REMOVED BY: 1 Tow Rotation List 2 Tow Owner's Request 3 Driver 4 Other ☐

OWNER'S FULL NAME (Check if Driver ☐) | CURRENT ADDRESS (Number and Street) | CITY AND STATE | ZIP CODE

OWNER'S FULL NAME (Trailer or Towed Vehicle) | CURRENT ADDRESS (Number and Street) | CITY AND STATE | ZIP CODE

DRIVER (Exactly as on Driver's License)/Pedestrian | CURRENT ADDRESS (Number and Street) | CITY AND STATE | ZIP CODE | DATE OF BIRTH

DRIVER'S LICENSE NUMBER | STATE | LIC. TYPE | BAC TEST 1 Blood 2 Breath 3 Urine 4 Refused 5 None ☐ | RESULTS . % | ALC/DRUG | PHYS. DEF. | RES | RACE | SEX | INJ. | S. EQUIP. | EJECT.

Pedestrian

HAZARDOUS MATERIALS BEING TRANSPORTED 1 None 2 Flammable Liquid 3 Explosives 4 Poisonous Gas 5 Corrosive Materials 6 Radioactive Materials 7 Other ☐ | Driving Ability Questionable RECOMMEND RE-EXAM 1 YES 2 NO 3 NOT APPLICABLE If YES, Explain in Narrative ☐ | Driver's Phone No. ( )

# PASSENGER'S NAME	CURRENT ADDRESS	CITY & STATE/ZIP CODE	AGE	LOC	INJ.	S. EQUIP.	EJECT.
1.							
# PASSENGER'S NAME 2.	CURRENT ADDRESS	CITY & STATE/ZIP CODE					
# PASSENGER'S NAME 3.	CURRENT ADDRESS	CITY & STATE/ZIP CODE					

Code Information

VEHICLE TYPE
01 Passenger Vehicle
02 Passenger Van
03 Recreational
04 Truck (Light) Pickup
05 Truck (Heavy)
06 Truck-Tractor
07 Motorcycle
08 Off-Road Vehicle
09 Moped
10 Bicycle
11 Law Enforcement Vehicle
12 Fire Vehicle
13 Ambulance
14 Rescue Unit
15 Taxicab
16 Public School Bus
17 Private School Bus
18 City Transit Bus
19 Commercial Bus
20 Other Type Bus
21 Special Mobile Equipment
22 Farm Equipment
23 Government
24 Military
25 Train
26 Trailer
27 Towed Vehicle
28 Other

RESIDENCE (DRIVER ONLY)
1 County of Crash
2 Elsewhere in State
3 Non-Resident State
4 Foreign 5 Unknown

LICENSE TYPE
1 Operator 4 Motor-cycle
2 Chauffeur
3 Res. Operator 5 None

RACE
1 White
2 Black
3 Hispanic
4 Other

SEX
1 Male
2 Female

PHYSICAL DEFECTS
1 No Defects Known
2 Eyesight Defect
3 Fatigue/Asleep
4 Hearing Defect
5 ILL
6 Seizure, Epilepsy, Blackout
7 Other Physical Defect

INJURY SEVERITY
1 No Injury
2 Possible Injury
3 Non-Incapacitating Injury
4 Incapacitating Injury
5 Fatal (Within 90 Days) Injury
6 Non-Traffic Fatality

ALCOHOL/DRUG USE
1 Not Drinking or Using Drugs
2 Alcohol-Under Influence
3 Drugs-Under Influence
4 Alcohol & Drugs-Under Influence
5 Had Been Drinking
6 Pending BAC Test Result

SAFETY EQUIPMENT IN USE
1 Not in Use
2 Seat Belt/Shoulder Harness
3 Child Restraint
4 Safety Helmet/Eye Protection
5 Air Bag
6 Other: ______

LOCATION IN VEHICLE
1 Front Left
2 Front Center
3 Front Right
4 Rear Left
5 Rear Center
6 Rear Right
7 In Body of Truck
8 Bus Passenger
9 Other

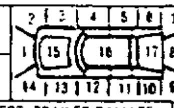
EJECTED
1 No
2 Yes
3 Partial

INVESTIGATOR — RANK AND SIGNATURE | ID/BADGE NUMBER | DEPARTMENT | 1☐ FHP 3☐ CPD 2☐ SO 4☐ OTHER

HSMV 90003 (REV. 11/90) S

Page 1 Of ______ Pages

DRIVER ACTION 1 Phantom 2 Hit & Run 3 N/A	YEAR	MAKE	TYPE	VEH. LICENSE NUMBER	STATE	VEHICLE IDENTIFICATION NUMBER
TRAILER OR TOWED VEHICLE INFORMATION						



POINT OF IMPACT

CIRCLE AREA OF DAMAGE
18 Undercarriage
19 Overturn
20 Windshield
21 Fire 22 Trailer

Vehicle

VEHICLE TRAVELING ☐ N ☐ S ☐ E ☐ W ON At Est. MPH | Posted Speed | EST. VEHICLE DAMAGE $ | 1 Disabling 2 Functional 3 No Damage | EST. TRAILER DAMAGE $

INSURANCE CO (LIABILITY OR PIP) | POLICY NUMBER | VEHICLE REMOVED BY: 1 Tow Rotation List 2 Tow Owner's Request 3 Driver 4 Other

OWNER'S FULL NAME (Check if Driver ☐) | CURRENT ADDRESS (Number and Street) | CITY AND STATE | ZIP CODE

OWNER'S FULL NAME (Trailer or Towed Vehicle) | CURRENT ADDRESS (Number and Street) | CITY AND STATE | ZIP CODE

DRIVER (Exactly as on Driver's License)/Pedestrian | CURRENT ADDRESS (Number and Street) | CITY AND STATE | ZIP CODE | DATE OF BIRTH

Pedestrian

DRIVER'S LICENSE NUMBER | STATE | LIC. TYPE | BAC TEST 1 Blood 2 Breath 3 Urine 4 Refused 5 None | RESULTS % | AL/DRUG | PHYS. DEF. | RES | RACE | SEX | INJ | S. EQUIP. | EJECT.

HAZARDOUS MATERIALS BEING TRANSPORTED 1 None 2 Flammable Liquid 3 Explosives 4 Poisonous Gas 5 Corrosive Materials 6 Radioactive Materials 7 Other | Driving Ability Questionable RECOMMEND RE-EXAM 1 YES 2 NO 3 NOT APPLICABLE If YES, Explain in Narrative | Driver's Phone No. ( )

PASSENGER'S NAME	CURRENT ADDRESS	CITY & STATE/ZIP CODE	AGE	LOC	INJ	S. EQUIP.	EJECT.
* PASSENGER'S NAME 1.	CURRENT ADDRESS	CITY & STATE/ZIP CODE					
* PASSENGER'S NAME 2.	CURRENT ADDRESS	CITY & STATE/ZIP CODE					
* PASSENGER'S NAME 3.	CURRENT ADDRESS	CITY & STATE/ZIP CODE					

	EST. AMOUNT	OWNER'S NAME	ADDRESS	CITY	STATE	ZIP
* PROPERTY DAMAGED - OTHER THAN VEHICLES 1	$					
* PROPERTY DAMAGED - OTHER THAN VEHICLES 2.	$					

CONTRIBUTING CAUSES-DRIVER/PED. 1 2 3
01 No Improper Driving/Action
02 Careless Driving
03 Failed to Yield Right-of-Way
04 Improper Backing
05 Improper Lane Change
06 Improper Turn
07 Alcohol-Under Influence
08 Drugs-Under Influence
09 Alcohol & Drugs-Under Influence
10 Followed Too Closely
11 Disregarded Traffic Signal
12 Exceeded Safe Speed Limit
13 Disregarded Stop Sign
14 Failed to Maintain Equip./Vehicle
15 Improper Passing
16 Drove Left of Center
17 Exceeded Stated Speed Limit
18 Obstructing Traffic
19 Improper Load
20 Disregarded Other Traffic Control
21 Driving Wrong Side/Way
77 All Other (Explain in Narrative)

VEHICLE DEFECT 1 2 3
01 No Defects
02 Def. Brakes
03 Worn/Smooth Tires
04 Defective/Improper Lights
05 Puncture/Blowout
06 Steering Mech.
07 Windshield Wipers
08 Equipment/Vehicle Defect
77 All Other (Explain in Narrative)

VEHICLE MOVEMENT 1 2 3
01 Straight Ahead
02 Slowing/Stopped/Stalled
03 Making Left Turn
04 Backing
05 Making Right Turn
06 Changing Lanes
07 Entering/Leaving Parking Space
08 Properly Parked
09 Improperly Parked
10 Making U-Turn
11 Passing
12 Driverless or Runaway Veh.
77 All Other (Explain in Narrative)

VEHICLE FUNCTION 1 2 3
01 None
02 Pulling Semi-Trailer
03 Pulling Other Veh.
04 Emergency Operation
05 Truck-Tractor Pulling Two Trailers
06 Pulling Tank Trailer
07 Pulling House Trailer
08 Pulling Small Trailer
09 Veh. Being Towed/Pushed
10 Pulling Pole Trailer
11 Pulling Saddle Mount
12 Police Pursuit
77 All Other (Explain)

VEHICLE MODIFIED 1 2 3
01 Yes (If Yes, Explain)
02 No
03 Not Applicable

LOCATION ON ROADWAY 1 2 3
01 On Road
02 Not On Road
03 Shoulder
04 Median
05 Turn Lane/Safety Zone

PEDESTRIAN ACTION 1 2 3
01 Crossing Not at Intersection
02 Crossing at Intersection
03 Walking Along Road With Traffic
04 Walking Along Road Against Traffic
05 Pushing/Working on Vehicle in Road
06 Other Working in Road
07 Standing/Playing in Road
77 All Other (Explain)
88 Unknown

FIRST/SUBSEQUENT HARMFUL EVENT F S
01 Collision With MV in Transport (Rear-end)
02 Collision With MV in Transport (Angle)
03 Collision With MV in Transport (Left Turn)
04 Collision With Parked Car
05 Collision With MV in Transport (Sideswipe)
06 Collision With MV in Transport (Backed into)
07 Collision With MV in Transport (Right Turn)
08 MV Hit Other Fixed Object
09 MV Hit Utility Pole/Light Pole
10 Collision With MV in Transport (Head-on)
11 Collision With Pedestrian
12 Collision With Moped
13 MV Hit Tree/Shrubbery
14 Collision With Bicycle
15 Collision With Bicycle (Bike Lane)
16 MV Ran into Ditch/Culvert
17 Ran Off Road Into Water
18 Overturned
19 MV Hit Fence
20 Collision With MV on Other Roadway
21 MV Hit Sign/Sign Post
22 MV Hit Guardrail
23 Collision With Fixed Object Above Road
24 Fire
25 Collision With Animal
26 Collision With Moveable Object On Road
27 MV Hit Concrete Barrier Wall
28 MV Hit Bridge/Pier/Abutment Rail
29 Occupant Fell From Vehicle
30 Tractor/Trailer Jackknifed
31 Collision With Construction Barricade/Sign in Road
32 Collision With Traffic Gate
33 Collision With Crash Attenuators
34 Collision With Train
35 Explosion
77 All Other (Explain)

ROAD SYSTEM IDENTIFIER
01 Interstate
02 U.S.
03 State
04 County
05 Local
06 Turnpike
07 Other Full Control
08 Other Major Arterial
77 All Other (Explain)

LIGHTING CONDITION
01 Daylight
02 Dusk
03 Dawn
04 Dark (Street Light)
05 Dark (No Street Light)
88 Unknown

ROAD SURFACE/CONDITION
01 Dry
02 Wet
03 Slippery
04 Icy
77 All Other (Explain)

WEATHER
01 Clear
02 Cloudy
03 Rain
04 Fog
77 All Other (Explain)

ROAD SURFACE TYPE
01 Slag/Gravel/Stone
02 Blacktop
03 Brick/Block
04 Concrete
05 Dirt
77 All Other (Explain)

CONTRIBUTING CAUSES-ROAD
01 No Defects
02 Obstruction With/Without Warning
03 Road Under Repair/Construction
04 Loose Surface Materials
05 Shoulders-Soft/Low/High
06 Holes/Ruts/Unsafe Paved Edge
07 Standing Water
08 Worn/Polished Road Surface
77 All Other (Explain)

CONTRIBUTING CAUSES-ENVIRONMENT
01 Vision Not Obscured
02 Inclement Weather
03 Parked/Stopped Vehicle
04 Trees/Crops/Bushes
05 Load on Vehicle
06 Building/Fixed Object
07 Signs/Billboards
08 Fog
09 Smoke
10 Glare
77 All Other (Explain)

TRAFFIC CONTROL
01 No Control
02 Speed Control Zone
03 Traffic Signal
04 Stop Sign
05 Yield Sign
06 Flashing Light
07 Railroad Signal
08 Officer/Guard/Flagman
09 Posted No U-Turn
10 School Zone
77 All Other (Explain)

SITE LOCATION
01 Not At Intersection/RR X'ing/Bridge
02 At Intersection
03 Influenced By Intersection
04 Driveway Access
05 Railroad Crossing
06 Bridge
07 Entrance Ramp
08 Exit Ramp
09 Parking Lot-Public
10 Parking Lot-Private
11 Private Property
77 All Other (Explain)

TRAFFICWAY CHARACTER
01 Straight-Level
02 Straight-Upgrade/Downgrade
03 Curve-Level
04 Curve-Upgrade/Downgrade

TYPE SHOULDER
01 Paved
02 Unpaved

WITNESS-NAME	ADDRESS	CITY & STATE	ZIP
1			
2			

VIOLATOR	FL STATUTE NUMBER	NAME	CHARGE	CITATION #

FLORIDA TRAFFIC CRASH REPORT

UPDATE ☐ CONTINUATION ☐

MAIL TO: DEPT. OF HIGHWAY SAFETY & MOTOR VEHICLES
TRAFFIC CRASH RECORDS
TALLAHASSEE, FLORIDA 32399-0500

DO NOT WRITE IN THIS SPACE

COUNTY/CITY CODE	DATE OF CRASH	INVEST. AGENCY REPORT NUMBER	HSMV CRASH REPORT NUMBER

Section

DRIVER ACTION 1 Phantom 2 Hit & Run 3 N/A	YEAR	MAKE	TYPE	VEH. LICENSE NUMBER	STATE	VEHICLE IDENTIFICATION NUMBER
TRAILER OR TOWED VEHICLE INFORMATION						

POINT OF IMPACT ☐

CIRCLE AREA OF DAMAGE
18 Undercarriage
19 Overturn
20 Windshield
21 Fire 22 Trailer

Vehicle

VEHICLE TRAVELING ☐N ☐S ☐E ☐W ON At Est. MPH | Posted Speed | EST. VEHICLE DAMAGE $ 1 Disabling 2 Functional 3 No Damage ☐ | EST. TRAILER DAMAGE $

INSURANCE CO. (LIABILITY OR PIP) | POLICY NUMBER | VEHICLE REMOVED BY: 1 Tow Rotation List 2 Tow Owner's Request 3 Driver 4 Other ☐

OWNER'S FULL NAME (Check if Driver ☐) | CURRENT ADDRESS (Number and Street) | CITY AND STATE | ZIP CODE

OWNER'S FULL NAME (Trailer or Towed Vehicle) | CURRENT ADDRESS (Number and Street) | CITY AND STATE | ZIP CODE

Pedestrian

DRIVER (Exactly as on Driver's License)/Pedestrian | CURRENT ADDRESS (Number and Street) | CITY AND STATE | ZIP CODE | DATE OF BIRTH

DRIVER'S LICENSE NUMBER	STATE	LIC. TYPE	BAC TEST 1 Blood 2 Breath 3 Urine 4 Refused 5 None ☐	RESULTS . %	AL/DRUG	PHYS. DEF.	RES	RACE	SEX	INJ	S. EQUIP.	EJECT.

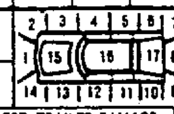
HAZARDOUS MATERIALS BEING TRANSPORTED 1 None 2 Flammable Liquid 3 Explosives 4 Poisonous Gas 5 Corrosive Materials 6 Radioactive Materials 7 Other ☐ | Driving Ability Questionable RECOMMEND RE-EXAM 1 YES 2 NO 3 NOT APPLICABLE If YES, Explain in Narrative ☐ | Driver's Phone No. ( )

# PASSENGER'S NAME	CURRENT ADDRESS	CITY & STATE/ZIP CODE	AGE	LOC	INJ	S. EQUIP.	EJECT.

# PASSENGER'S NAME	CURRENT ADDRESS	CITY & STATE/ZIP CODE

Section

DRIVER ACTION 1 Phantom 2 Hit & Run 3 N/A	YEAR	MAKE	TYPE	VEH. LICENSE NUMBER	STATE	VEHICLE IDENTIFICATION NUMBER
TRAILER OR TOWED VEHICLE INFORMATION						



POINT OF IMPACT ☐

CIRCLE AREA OF DAMAGE
18 Undercarriage
19 Overturn
20 Windshield
21 Fire 22 Trailer

Vehicle

VEHICLE TRAVELING ☐N ☐S ☐E ☐W ON At Est. MPH | Posted Speed | EST. VEHICLE DAMAGE $ 1 Disabling 2 Functional 3 No Damage ☐ | EST. TRAILER DAMAGE $

INSURANCE CO. (LIABILITY OR PIP) | POLICY NUMBER | VEHICLE REMOVED BY: 1 Tow Rotation List 2 Tow Owner's Request 3 Driver 4 Other ☐

OWNER'S FULL NAME (Check if Driver ☐) | CURRENT ADDRESS (Number and Street) | CITY AND STATE | ZIP CODE

OWNER'S FULL NAME (Trailer or Towed Vehicle) | CURRENT ADDRESS (Number and Street) | CITY AND STATE | ZIP CODE

Pedestrian

DRIVER (Exactly as on Driver's License)/Pedestrian | CURRENT ADDRESS (Number and Street) | CITY AND STATE | ZIP CODE | DATE OF BIRTH

DRIVER'S LICENSE NUMBER	STATE	LIC. TYPE	BAC TEST 1 Blood 2 Breath 3 Urine 4 Refused 5 None ☐	RESULTS . %	AL/DRUG	PHYS. DEF.	RES	RACE	SEX	INJ	S. EQUIP.	EJECT.

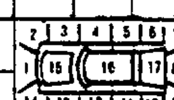
HAZARDOUS MATERIALS BEING TRANSPORTED 1 None 2 Flammable Liquid 3 Explosives 4 Poisonous Gas 5 Corrosive Materials 6 Radioactive Materials 7 Other ☐ | Driving Ability Questionable RECOMMEND RE-EXAM 1 YES 2 NO 3 NOT APPLICABLE If YES, Explain in Narrative ☐ | Driver's Phone No. ( )

# PASSENGER'S NAME	CURRENT ADDRESS	CITY & STATE/ZIP CODE	AGE	LOC	INJ	S. EQUIP.	EJECT.

# PASSENGER'S NAME	CURRENT ADDRESS	CITY & STATE/ZIP CODE

Section

DRIVER ACTION 1 Phantom 2 Hit & Run 3 N/A	YEAR	MAKE	TYPE	VEH. LICENSE NUMBER	STATE	VEHICLE IDENTIFICATION NUMBER
TRAILER OR TOWED VEHICLE INFORMATION						



POINT OF IMPACT ☐

CIRCLE AREA OF DAMAGE
18 Undercarriage
19 Overturn
20 Windshield
21 Fire 22 Trailer

Vehicle

VEHICLE TRAVELING ☐N ☐S ☐E ☐W ON At Est. MPH | Posted Speed | EST. VEHICLE DAMAGE $ 1 Disabling 2 Functional 3 No Damage ☐ | EST. TRAILER DAMAGE $

INSURANCE CO. (LIABILITY OR PIP) | POLICY NUMBER | VEHICLE REMOVED BY: 1 Tow Rotation List 2 Tow Owner's Request 3 Driver 4 Other ☐

OWNER'S FULL NAME (Check if Driver ☐) | CURRENT ADDRESS (Number and Street) | CITY AND STATE | ZIP CODE

OWNER'S FULL NAME (Trailer or Towed Vehicle) | CURRENT ADDRESS (Number and Street) | CITY AND STATE | ZIP CODE

Pedestrian

DRIVER (Exactly as on Driver's License)/Pedestrian | CURRENT ADDRESS (Number and Street) | CITY AND STATE | ZIP CODE | DATE OF BIRTH

DRIVER'S LICENSE NUMBER	STATE	LIC. TYPE	BAC TEST 1 Blood 2 Breath 3 Urine 4 Refused 5 None ☐	RESULTS . %	AL/DRUG	PHYS. DEF.	RES	RACE	SEX	INJ	S. EQUIP.	EJECT.

HAZARDOUS MATERIALS BEING TRANSPORTED 1 None 2 Flammable Liquid 3 Explosives 4 Poisonous Gas 5 Corrosive Materials 6 Radioactive Materials 7 Other ☐ | Driving Ability Questionable RECOMMEND RE-EXAM 1 YES 2 NO 3 NOT APPLICABLE If YES, Explain in Narrative ☐ | Driver's Phone No. ( )

# PASSENGER'S NAME	CURRENT ADDRESS	CITY & STATE/ZIP CODE	AGE	LOC	INJ	S. EQUIP.	EJECT.

INVESTIGATOR — RANK AND SIGNATURE	ID/BADGE NUMBER	DEPARTMENT	1☐ FHP 3☐ CPD 2☐ SO 4☐ OTHER

HSMV 90004 (REV. 11/90) S

Page ______ Of ______ Pages

# PROPERTY DAMAGED - OTHER THAN VEHICLES	EST. AMOUNT	OWNER'S NAME	ADDRESS	CITY	STATE	ZIP
	$					

# PROPERTY DAMAGED - OTHER THAN VEHICLES	EST. AMOUNT	OWNER'S NAME	ADDRESS	CITY	STATE	ZIP
	$					

# PROPERTY DAMAGED - OTHER THAN VEHICLES	EST. AMOUNT	OWNER'S NAME	ADDRESS	CITY	STATE	ZIP
	$					

# PROPERTY DAMAGED - OTHER THAN VEHICLES	EST. AMOUNT	OWNER'S NAME	ADDRESS	CITY	STATE	ZIP
	$					

CONTRIBUTING CAUSES-DRIVER/PED

01 No Improper Driving/Action
02 Careless Driving
03 Failed to Yield Right-of-Way
04 Improper Backing
05 Improper Lane Change
06 Improper Turn
07 Alcohol-Under Influence
08 Drugs-Under Influence
09 Alcohol & Drugs-Under Influence
10 Followed Too Closely
11 Disregarded Traffic Signal
12 Exceeded Safe Speed Limit
13 Disregarded Stop Sign
14 Failed to Maintain Equip./Vehicle
15 Improper Passing
16 Drove Left of Center
17 Exceeded Stated Speed Limit
18 Obstructing Traffic
19 Improper Load
20 Disregarded Other Traffic Control
21 Driving Wrong Side/Way
77 All Other (Explain in Narrative)

DEFECT VEHICLE

01 No Defects
02 Def. Brakes
03 Worn/Smooth Tires
04 Defective/Improper Lights
05 Puncture/Blowout
06 Steering Mech.
07 Windshield Wipers
08 Equipment/Vehicle Defect
77 All Other (Explain in Narrative)

VEHICLE MOVEMENT

01 Straight Ahead
02 Slowing/Stopped/Stalled
03 Making Left Turn
04 Backing
05 Making Right Turn
06 Changing Lanes
07 Entering/Leaving Parking Space
08 Properly Parked
09 Improperly Parked
10 Making U-Turn
11 Passing
12 Driverless or Runaway Veh.
77 All Other (Explain in Narrative)

VEHICLE FUNCTION

01 None
02 Pulling Semi-Trailer
03 Pulling Other Veh
04 Emergency Operation
05 Truck Tractor Pulling Two Trailers
06 Pulling Tank Trailer
07 Pulling House Trailer
08 Pulling Small Trailer
09 Veh. Being Towed/Pushed
10 Pulling Pole Trailer
11 Pulling Saddle Mount
12 Police Pursuit
77 All Other (Explain)

VEHICLE MODIFIED

01 Yes (If Yes, Explain)
02 No
03 Not Applicable

LOCATION ON ROADWAY

01 On Road
02 Not On Road
03 Shoulder
04 Median
05 Turn Lane/Safety Zone

PEDESTRIAN ACTION

01 Crossing Not at Intersection
02 Crossing at Intersection
03 Walking Along Road With Traffic
04 Walking Along Road Against Traffic
05 Pushing/Working on Vehicle in Road
06 Other Working in Road
07 Standing/Playing in Road
77 All Other (Explain)
88 Unknown

Additional Passengers/Narrative

SEC. #	PASS. #	PASSENGER'S NAME	ADDRESS	CITY & STATE	ZIP	Age	Loc.	Inj.	Safety Equip.	Eject.

WITNESS-NAME	ADDRESS	CITY & STATE	ZIP

WAS INVESTIGATION MADE AT SCENE?
☐ 1 Yes
☐ 2 No-Where?

IS INVESTIGATION COMPLETE?
☐ 1 Yes
☐ 2 No-Why?

DATE OF REPORT

PHOTOS TAKEN?
☐ 1 Yes
☐ 2 No
☐ 3 Investigating Agency
☐ 4 Other ______

# VIOLATOR		NAME	CHARGE	CITATION #

HSMV 90004 (REV. 11/90) S

FLORIDA TRAFFIC CRASH REPORT

☐ Check Only If Update

DO NOT WRITE IN THIS SPACE

NARRATIVE AND DIAGRAM

MAIL TO: DEPT. OF HIGHWAY SAFETY & MOTOR VEHICLES
TRAFFIC CRASH RECORDS, TALLAHASSEE, FLORIDA 32399-0500

EMS INFO. FATALS ONLY	TIME EMS NOTIFIED AM PM	TIME EMS ARRIVED AM PM	COUNTY/CITY CODE	DATE OF CRASH	INVEST. AGENCY REPORT NUMBER	HSMV CRASH REPORT NUMBER

FIRST AID GIVEN BY - NAME: ☐ 1 Physician or Nurse ☐ 2 Paramedic Or EMT ☐ 3 Police Officer ☐ 4 Certified 1st Aider ☐ 5 Other

INJURED TAKEN TO:

BY - NAME:

WAS INVESTIGATION MADE AT SCENE? ☐ 1 Yes ☐ 2 No-Where?

IS INVESTIGATION COMPLETE? ☐ 1 Yes ☐ 2 No-Why?

DATE OF REPORT

PHOTOS TAKEN? ☐ 1 Yes ☐ 2 No ☐ 3 Investigating Agency ☐ 4 Other ________

INVESTIGATOR - RANK AND SIGNATURE

ID/BADGE NUMBER

DEPARTMENT

1 ☐ FHP 3 ☐ CPD 2 ☐ SO 4 ☐ OTHER

HSMV 90005 (REV. 11/90) S

Page ______ Of ______ Pages

DIAGRAM

INDICATE NORTH
WITH ARROW

Page ______ Of ______ Pages

HSMV 90005 (REV. 11/90) S

NUMB	D	CO	SEC	SUB	BMP	EMP	ROAD	LNGTH	SYSTEM	LANES	CRASHS	ADT	ACTUAL	CRITICAL	RATIO	FTL	INJ	PRTY	TOTAL	Y1	Y2
36	1	01	050	000	9.399	9.405 S	776	0.006	FAP R	2 DIV	8	8,562	2.559	2.067	1.238	0	6	2	$326,400	00	00
8	1	03	002	000	.000	.006 S	84	0.006	OSM R	2	8	3,935	5.569	2.801	1.988	1	14	0	$561,600	00	00
37	1	03	010	000	9.706	9.789 S	45	0.083	FAP U	6 DIV	18	31,592	1.560	1.267	1.231	0	9	11	$379,800	00	00
26	1	03	010	000	9.974	10.073 S	45	0.099	FAP U	6 DIV	19	29,708	1.752	1.287	1.361	0	6	13	$400,900	30	00
25	1	03	010	000	12.791	12.885 S	90	0.094	FAP U	4 DIV	32	43,647	2.008	1.417	1.417	0	17	19	$777,600	00	00
6	1	03	080	000	37.327	37.396 S	29	0.069	FAP U	4 DIV	17	11,282	4.128	2.013	2.050	0	9	10	$413,100	00	99
58	1	07	030	000	3.770	3.842 S	25	0.072	FAP U	4 DIV	8	10,217	2.145	2.071	1.035	0	10	2	$194,400	00	00
1	1	07	030	000	12.266	12.319 S	25	0.053	FAP R	4 DIV	13	6,436	5.533	1.494	3.703	0	21	1	$730,600	00	99
29	1	12	004	000	3.072	3.167 S	865	0.095	FAU U	4 DIV	11	11,491	2.622	2.003	1.309	0	15	4	$267,300	54	80
49	1	12	005	000	1.172	1.267 S	884	0.095	FAP U	4 DIV	18	28,462	1.732	1.570	1.103	1	7	12	$437,400	00	99
4	1	12	005	000	2.419	2.514 S	884	0.095	FAP U	4 DIV	36	24,080	4.095	1.638	2.500	0	36	14	$874,800	99	80
13	1	12	005	000	5.239	5.287 S	884	0.048	FAP U	4 DIV	27	26,467	2.794	1.599	1.747	0	13	15	$656,100	99	00
12	1	12	010	000	.991	1.029 S	45	0.038	FAP R	4 DIV	16	19,420	2.257	1.238	1.823	1	22	4	$899,200	99	00
38	1	12	010	000	21.341	21.439 S	45	0.098	FAP U	6 DIV	21	39,005	1.475	1.202	1.227	0	16	11	$443,100	65	65
27	1	12	010	000	21.991	22.064 S	45	0.073	FAP U	6 DIV	23	39,005	1.615	1.202	1.343	0	26	9	$485,300	52	00
45	1	12	010	000	22.793	22.883 S	45	0.090	FAP U	6 DIV	20	41,101	1.333	1.187	1.122	0	21	7	$422,000	99	99
15	1	12	010	000	23.028	23.118 S	45	0.090	FAP U	6 DIV	31	41,101	2.066	1.187	1.740	0	23	17	$654,100	99	99
56	1	12	010	000	23.281	23.361 S	45	0.080	FAP U	6 DIV	18	39,258	1.256	1.200	1.046	1	11	9	$379,800	00	00
24	1	12	010	000	25.328	25.414 S	45	0.086	FAP U	4 DIV	23	28,184	2.235	1.574	1.419	0	25	6	$558,900	00	00
54	1	12	020	000	2.514	2.543 S	80	0.029	FAP U	4 DIV	14	21,733	1.764	1.682	1.048	1	17	5	$340,200	99	99
53	1	12	060	000	7.450	7.545 S	78	0.095	FAP R	2	11	11,910	2.530	2.324	1.088	0	8	5	$772,200	99	80
30	1	12	070	000	.558	.646 S	82	0.088	FAP U	2 DIV	16	14,736	2.974	2.303	1.291	0	12	7	$411,200	00	00
41	1	12	070	000	4.480	4.527 S	82	0.047	FAP R	4 DIV	8	14,244	1.538	1.303	1.180	0	10	3	$449,600	00	00
22	1	13	010	000	5.210	5.303 S	45	0.093	FAP U	6 DIV	18	25,421	1.939	1.341	1.445	0	18	6	$379,800	00	99
19	1	13	010	000	6.002	6.076 S	45	0.074	FAP U	4 DIV	19	21,280	2.446	1.691	1.446	0	17	7	$461,700	99	99
10	1	13	010	000	6.534	6.620 S	45	0.086	FAP U	4	28	18,206	4.213	2.179	1.933	0	20	14	$560,000	99	99
40	1	13	010	000	7.246	7.320 S	45	0.074	FAP U	4	14	13,871	2.765	2.340	1.181	0	8	6	$280,000	00	00
23	1	13	010	000	7.492	7.561 S	45	0.069	FAP U	4	11	7,557	3.987	2.773	1.437	0	5	7	$220,000	00	00
57	1	13	010	000	7.594	7.608 S	45	0.014	FAP U	4	8	7,557	2.900	2.773	1.045	0	3	6	$160,000	00	00
55	1	13	010	001	.130	.223 S	45	0.093	FAP U	4 DIV	13	19,681	1.809	1.726	1.048	0	5	8	$315,900	99	99
18	1	13	020	000	1.182	1.259 S	43	0.077	FAP U	4 DIV	25	30,481	2.247	1.543	1.456	0	22	12	$607,500	00	49
44	1	13	020	000	3.824	3.891 S	43	0.067	FAP U	6 DIV	11	18,060	1.668	1.472	1.133	0	28	1	$232,100	00	99
42	1	13	030	000	.000	.095 S	45	0.095	FAP U	4	17	18,214	2.557	2.179	1.173	0	6	13	$340,000	00	00
32	1	13	030	000	.505	.524 S	45	0.019	FAP U	4 DIV	11	11,747	2.565	1.990	1.288	0	7	6	$267,300	99	00
46	1	13	040	000	6.919	7.014 S	684	0.095	FAU U	6 DIV	17	33,332	1.397	1.250	1.117	0	15	7	$358,700	14	92
16	1	13	150	000	5.451	5.548 S	64	0.097	FAU U	4 DIV	23	22,467	2.804	1.667	1.682	1	13	12	$558,900	99	94
31	1	13	160	000	.000	.058 S	70	0.058	FAP U	4 DIV	14	16,404	2.338	1.813	1.289	0	19	2	$340,200	00	00
39	1	16	010	000	.000	.000 S	600	0.001	FAP U	2 DIV	10	8,397	3.262	2.690	1.212	0	21	1	$257,000	00	00
28	1	16	010	101	.106	.187 S	600	0.081	FAP U	3	9	5,040	4.892	3.712	1.317	0	12	2	$172,800	00	00
35	1	16	020	000	.622	.679 S	600	0.057	FAP U	4	10	7,886	3.474	2.739	1.268	0	20	1	$200,000	00	99
59	1	16	020	000	9.149	9.207 S	600	0.058	FAP U	6 DIV	13	25,770	1.382	1.336	1.034	0	21	2	$274,300	00	00
33	1	16	020	000	11.580	11.580 S	600	0.001	FAP U	4 DIV	9	9,029	2.730	2.147	1.271	0	5	4	$218,700	00	00
63	1	16	020	000	22.207	22.268 S	600	0.061	FAP U	4 DIV	10	14,563	1.881	1.873	1.004	0	11	5	$243,000	00	00
47	1	16	030	000	28.074	28.074 S	555	0.001	FAP U	4	11	10,756	2.801	2.508	1.116	0	8	5	$220,000	00	00
17	1	16	030	000	29.143	29.206 S	555	0.063	FAP U	4 DIV	14	12,580	3.048	1.952	1.561	0	13	5	$340,200	00	99
64	1	16	100	000	3.906	3.920 S	546	0.014	FAP U	6 DIV	13	26,787	1.329	1.323	1.004	0	15	4	$274,300	99	99
50	1	16	140	000	.374	.412 S	544	0.038	FAP U	6 DIV	11	18,770	1.605	1.456	1.102	0	20	2	$232,100	00	00
11	1	16	140	000	.498	.564 S	544	0.066	FAP U	6 DIV	23	24,602	2.561	1.353	1.892	0	16	14	$485,300	96	00
5	1	16	180	000	16.088	16.184 S	25	0.096	FAP U	4 DIV	33	24,730	3.655	1.626	2.247	1	26	18	$801,900	99	99
62	1	16	180	000	18.684	18.684 S	25	0.001	FAP R	4 DIV	10	22,499	1.217	1.209	1.006	0	17	0	$562,000	00	00
52	1	16	210	000	.753	.801 S	35	0.048	FAP U	4 DIV	12	16,591	1.981	1.807	1.096	0	11	3	$291,600	00	00
7	1	16	210	000	2.630	2.706 S	700	0.076	FAP U	4 DIV	20	14,271	3.839	1.884	2.037	0	21	6	$486,000	99	99
2	1	16	210	000	2.998	3.070 S	700	0.072	FAP U	4 DIV	28	14,271	5.375	1.884	2.852	0	44	6	$680,400	99	99
51	1	16	210	000	6.132	6.160 S	700	0.028	FAP U	4 DIV	13	18,422	1.933	1.757	1.100	0	18	5	$315,900	00	92
34	1	16	250	000	26.350	26.445 S	37	0.095	FAU U	4 DIV	21	28,978	1.985	1.563	1.269	0	28	5	$510,300	00	00

NUMB	D	CO	SEC	SUB	BMP	EMP	ROAD	LNGTH	SYSTEM	LANES	CRASHS	ADT	ACTUAL	CRITICAL	RATIO	FTL	INJ	PRTY	TOTAL	Y1	Y2
130	1	01	010	000	18.412	21.011 S	45	2.599	FAP U	4 DIV	100	28,663	3.677	3.293	1.116	0	116	30	$2,600,000	99	99
5	1	01	050	000	2.184	3.837 S	776	1.653	FAP R	2 DIV	44	16,392	4.448	.869	5.118	0	46	18	$2,041,600	99	99
69	1	01	050	000	6.333	8.531 S	776	2.198	FAP R	2 DIV	8	6,432	1.550	.970	1.597	0	12	2	$371,200	99	78
117	1	01	050	000	11.147	13.987 S	776	2.840	FAP R	2	14	8,867	1.523	1.286	1.184	1	11	7	$1,047,200	41	73
7	1	01	060	000	9.206	10.226 S	776	1.020	FAP R	2 DIV	27	21,095	3.437	.903	3.806	0	27	10	$1,252,800	99	99
100	1	01	075	000	4.003	6.503 I	75	2.500	IS R	4 DIV	10	17,934	.611	.463	1.319	0	6	5	$711,000	00	00
127	1	01	075	000	7.503	10.213 I	75	2.710	IS R	4 DIV	9	17,306	.525	.459	1.143	0	7	4	$639,900	99	99
76	1	01	075	000	10.513	12.181 I	75	1.668	IS R	4 DIV	8	18,051	.727	.495	1.468	0	7	3	$568,800	99	99
110	1	01	075	000	15.871	17.895 I	75	2.024	IS R	4 DIV	9	20,863	.583	.467	1.248	0	8	4	$639,900	99	59
107	1	03	001	000	5.917	8.861 S	84	2.944	FAP R	2	10	5,290	1.759	1.387	1.268	1	10	1	$748,000	99	99
29	1	03	002	000	.000	2.859 S	84	2.859	OSH R	2	14	3,935	3.409	1.465	2.326	2	18	2	$1,047,200	00	99
98	1	03	010	000	11.679	14.659 S	45	2.980	FAP U	4 DIV	173	38,664	4.113	3.110	1.322	1	143	77	$4,498,000	99	99
152	1	03	010	000	18.492	20.261 S	90	1.769	FAP R	4 DIV	15	15,660	1.483	1.422	1.042	1	12	6	$886,500	99	00
48	1	03	010	000	25.047	27.914 S	90	2.867	FAP R	2	13	4,437	2.799	1.435	1.950	0	19	4	$972,400	65	99
89	1	03	030	000	6.765	7.315 S	951	0.550	FAP R	2	8	19,733	2.019	1.474	1.369	0	8	3	$598,400	99	00
42	1	03	080	000	36.822	37.828 S	29	1.006	FAP U	4 DIV	38	10,810	9.573	4.748	2.016	2	26	19	$988,000	99	99
52	1	03	175	000	60.273	61.393 I	75	1.120	IS R	4 DIV	10	25,720	.951	.499	1.905	0	9	2	$711,000	99	99
54	1	04	010	000	6.669	9.169 S	31	2.500	FAP R	2	10	3,951	2.773	1.499	1.849	0	10	4	$748,000	00	99
40	1	04	020	000	.368	3.349 S	35	2.981	FAP R	2	12	3,661	3.012	1.473	2.044	0	20	2	$897,600	99	99
65	1	04	020	000	10.323	12.370 S	35	2.047	FAP R	2	13	7,643	2.276	1.386	1.642	4	18	2	$972,400	99	99
90	1	04	020	000	19.392	22.122 S	35	2.730	FAP R	2	11	5,848	1.887	1.382	1.365	0	9	4	$822,800	00	00
145	1	04	040	000	12.972	13.984 S	70	1.012	FAP U	2	16	7,466	5.801	5.429	1.068	0	27	3	$448,000	99	99
41	1	04	060	000	6.199	8.916 S	72	2.717	FAP R	2	9	2,841	3.194	1.564	2.042	0	12	0	$673,200	99	00
71	1	06	010	000	11.437	13.779 S	35	2.342	FAP R	2	18	10,471	2.010	1.291	1.556	0	24	4	$1,346,400	00	99
1	1	06	010	000	13.836	14.839 S	35	1.003	FAP R	4	39	13,844	7.695	.351	21.923	0	41	15	$1,840,800	99	99
73	1	06	010	000	16.136	17.792 S	35	1.656	FAP R	2	13	10,303	2.087	1.367	1.526	0	29	0	$972,400	99	13
88	1	06	030	000	.077	2.685 S	636	2.608	FAP R	2	9	4,757	1.987	1.441	1.378	0	10	4	$673,200	00	00
44	1	06	050	000	17.418	20.067 S	64	2.649	FAP R	2	8	2,583	3.203	1.597	2.005	0	5	3	$598,400	41	89
123	1	07	010	000	.200	2.297 S	80	2.097	FAP R	2	8	6,373	1.640	1.423	1.152	1	7	2	$598,400	00	00
9	1	07	010	000	8.802	9.231 S	80	0.429	FAP R	2	8	9,118	5.603	1.755	3.192	0	13	2	$598,400	00	00
136	1	07	030	000	2.317	4.192 S	25	1.875	FAP U	4 DIV	36	11,865	4.433	4.051	1.094	1	33	16	$936,000	00	00
2	1	07	030	000	12.166	12.319 S	25	0.153	FAP R	4 DIV	14	6,651	37.692	2.266	16.633	0	23	1	$827,400	99	00
57	1	07	060	000	.454	3.435 S	29	2.981	FAP R	2	10	3,482	2.639	1.486	1.775	0	18	1	$748,000	00	00
75	1	07	060	000	7.300	10.185 S	29	2.885	FAP R	2	8	3,392	2.239	1.501	1.491	0	23	0	$598,400	00	03
8	1	07	060	000	10.645	13.385 S	29	2.740	FAP R	2	17	3,392	5.011	1.514	3.309	1	21	2	$1,271,600	99	99
14	1	07	060	000	13.645	15.572 S	29	1.927	FAP R	2	11	3,392	4.610	1.610	2.863	1	10	4	$822,800	99	99
4	1	07	060	000	16.205	16.775 S	29	0.570	FAP R	2	10	5,051	9.516	1.839	5.174	0	15	1	$748,000	99	99
6	1	07	060	000	16.844	17.414 S	29	0.570	FAP R	2 DIV	10	8,758	5.488	1.155	4.751	2	8	2	$464,000	99	99
132	1	09	010	000	18.368	21.309 S	25	2.941	FAP R	4 DIV	23	14,457	1.482	1.341	1.105	1	42	0	$1,359,300	99	00
99	1	09	030	000	.000	1.083 S	700	1.083	FAP R	4 DIV	16	20,880	1.938	1.465	1.322	1	25	1	$945,600	00	00
30	1	09	040	000	4.362	6.065 S	17	1.703	FAP R	2	9	3,938	3.676	1.603	2.293	1	14	2	$673,200	99	00
133	1	12	001	000	.000	.840 S	739	0.840	FAU U	2 DIV	25	22,028	3.701	3.355	1.103	0	26	11	$560,000	00	00
82	1	12	001	000	1.245	2.513 S	739	1.268	FAU U	4	52	22,906	4.905	3.442	1.425	1	56	13	$1,029,600	99	99
36	1	12	004	000	2.684	3.184 S	865	0.500	FAU U	4 DIV	32	15,411	11.377	5.172	2.199	1	39	10	$832,000	99	99
134	1	12	004	000	4.066	4.664 S	865	0.598	FAU U	2 DIV	10	9,094	5.037	4.593	1.096	0	13	1	$224,000	31	00
70	1	12	005	000	1.172	3.302 S	884	2.130	FAP U	4 DIV	108	25,500	5.447	3.451	1.578	1	84	56	$2,808,000	99	99
34	1	12	005	000	15.255	18.236 S	884	2.981	FAP R	2	31	10,204	2.792	1.250	2.233	1	42	7	$2,318,800	99	99
92	1	12	005	000	18.255	21.200 S	884	2.945	FAP R	2	17	9,186	1.721	1.272	1.352	0	28	3	$1,271,600	99	99
94	1	12	010	000	.741	3.578 S	45	2.837	FAP R	4 DIV	35	19,307	1.750	1.299	1.347	2	53	8	$2,068,500	99	99
120	1	12	010	000	10.500	13.052 S	45	2.552	FAP R	4 DIV	47	35,162	1.434	1.230	1.165	1	77	11	$2,777,700	99	99
154	1	12	010	000	18.857	21.855 S	45	2.998	FAP U	6 DIV	210	45,559	4.212	4.071	1.034	2	157	116	$4,641,000	99	99
67	1	12	010	000	21.865	23.361 S	45	1.496	FAP U	6 DIV	158	40,360	7.169	4.481	1.599	1	140	73	$3,491,800	99	99
106	1	12	010	000	23.388	23.673 S	45	0.285	FAP U	2	25	37,899	6.341	4.972	1.275	0	17	14	$700,000	99	99
156	1	12	020	000	.659	1.666 S	80	1.007	FAP U	2	32	19,620	4.437	4.349	1.020	0	30	14	$896,000	99	99
66	1	12	020	000	2.073	3.820 S	80	1.747	FAP U	4 DIV	81	21,633	5.871	3.665	1.601	2	78	37	$2,106,000	99	99

FRICTION NUMBER GUIDELINES

Table 1, Appendix E-1, Highway Safety Improvement Program Guideline

Revised July 28, 1989

POSTED SPEED LIMIT	ALL HIGHWAY SECTION SURFACES		
	QUESTIONABLE[1]	REVIEW[2]	DESIRED[3]
MPH	FN 40	FN 40	FN 40
Less than or Equal to 45	25	26 - 28	30
Greater than 45	27	28 - 30	35

NOTES:

1. Existing Pavements

   Warrants investigation to determine if corrective action is necessary. Investigation includes review of the traffic crash summary to determine percent of wet weather crashes, geometrics, surface conditions, drainage, posted speed, traffic density, etc.

   New Pavements

   Warrants monitoring traffic crashes as they occur for a period of 18 months to determine if wet pavement is a factor. Contact with police officials responsible for investigating crashes on the questionable section must be established by District Safety Engineer in order to receive the reports at the District level.

2. Existing Pavements

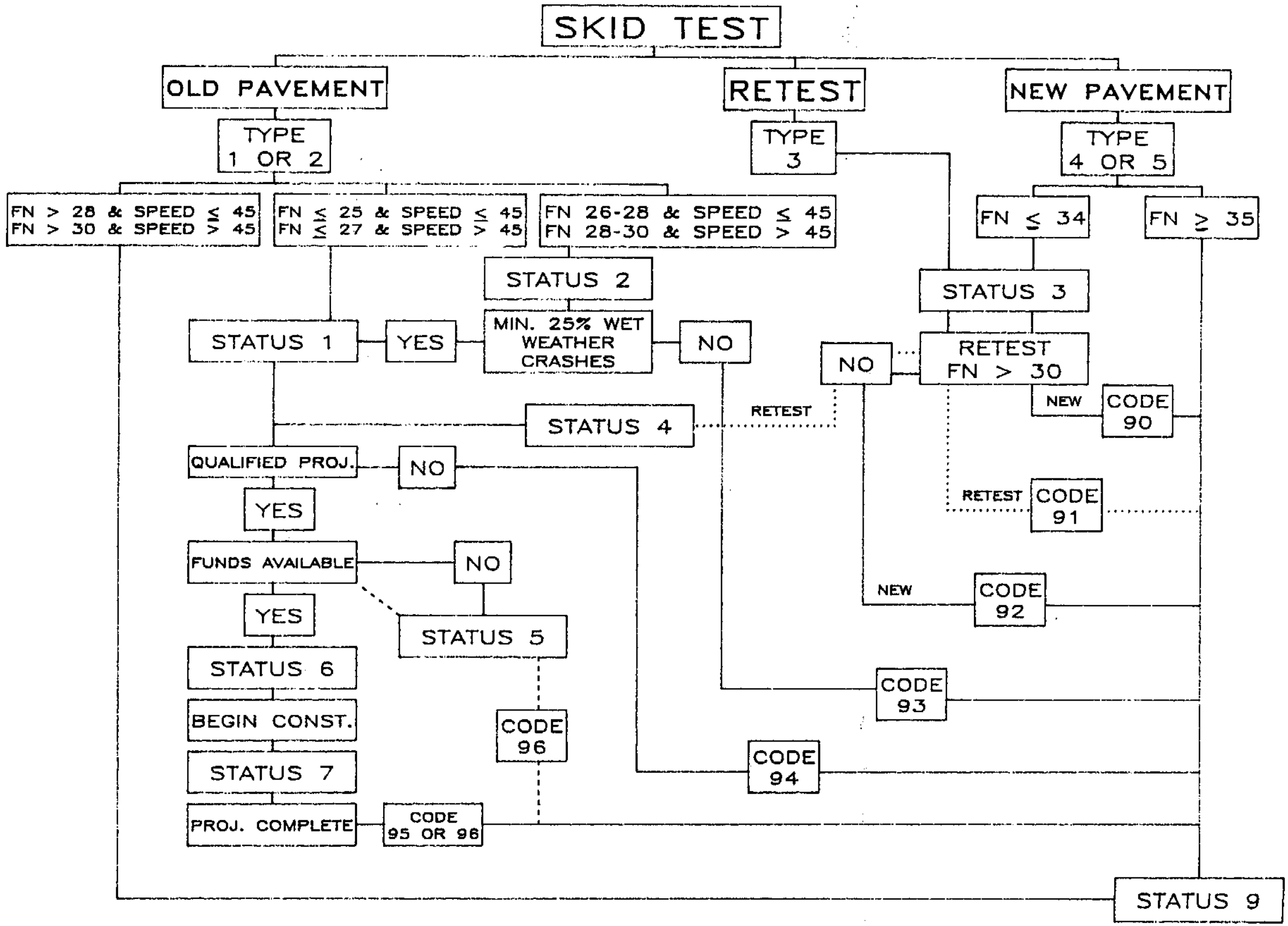
   Warrants review to determine if section appears on 25% or 50% wet weather crash list. If on list, investigate as outlined in Note 1.

   New Pavements

   Warrants monitoring traffic crashes as they occur for a period of 18 months to determine if wet pavement is a factor. Contact with police officials responsible for investigating crashes on the questionable section must be established by District Safety Engineer in order to receive the reports at the District level.

3. Desired value for new pavement surfaces.

SKID TEST RECORD SYSTEM



SKID TEST TYPE: 1 = INVENTORY, 2 = SPOT HAZARD, 3 = SPECIAL OR RETEST, 4 = SKID PROJ., 5 = NEW CONST

STATUS DESCRIPTIONS

Status 1 — Warrants investigation by the District Safety Engineer (DSE) to determine if corrective action is necessary. Investigation includes review of the traffic crash summary to determine percent of wet weather crashes, geometrics, surface condition, drainage, posted speed, traffic density, etc.

Status 2 — Warrants investigation by the DSE to determine if location has a minimum of 25% wet weather crashes. If yes, investigate as outlined in Status 1.

Status 3 — The District Safety Engineer must determine the purpose of the test.

a. If the test was a special reinventory request, the DSE should determine the appropriate status 1, 2, or 9 based on the criteria in Table 1, Appendix E-1, move the test to that status and process accordingly.

b. If the test is an original test of a new pavement surface with a FN $\leq$ 28 at speed limits $\leq$ 45 MPH or a FN $\leq$ 30 at speed limits > 45 MPH, the District Safety Engineer shall monitor traffic crashes as they occur for a period of up to 18 months after project completion to determine if the pavement is a factor in traffic crashes. The Materials Office shall review project records and/or investigate field conditions if the FN $\leq$ 30 and retest the section within one year if the FN $\leq$ 34.

c. If the test is a retest of a substandard new pavement test the DSE is to determine if the pavement is a factor in traffic crashes, reference the test records to each other and determine if the records should remain in status 3 for further monitoring of traffic crash reports or be moved to status 4 and processed accordingly.

Status 4 — Warrants investigation by the DSE to determine if corrective action is necessary. Investigation includes review of traffic crash report to determine percent of wet weather crashes, geometrics, surface condition, drainage, posted speed, etc.

Status 5 — Qualified project: With no funds available

Status 6 — Valid project: Scheduled in 5-year work program

Status 7 — Valid project: Under construction

Status 9 — History file or skid test records

STATUS 9 DISPOSITION CODE DEFINITIONS

90	Retest acceptable (I.D. No. __________)
91	No action required, FN adequate
92	Retest FN $\leq$ 30 (I.D. No. __________)
93	Does not qualify - less than 25% wet weather crashes
94	Does not qualify
95	Skid hazard resurfacing complete (WPI __________)
96	Skid problem corrected by completed construction project (WPI __________)

FORM 511-14
SAFETY
07/81

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

DISPOSITION OF FATAL CRASH

DATE RECEIVED		DATE OF CRASH
SECTION	STATE ROAD	CRASH NO.
DATE INVESTIGATED		DATE DISPOSED OF

INITIAL ACTION

☐ Obvious (crash description) roadway features not contributory
☐ Not part of significant increase in fatal crashes
☐ No action required

Field Investigated Date ______________________

☐ Roadway feature not involved
☐ Minor corrections needed
  ☐ Sent to Maintenance
  ☐ Sent to Traffic Operations
  ☐ Memo attached
☐ Crash study initiated

The following action is recommended: .

DISTRICT SAFETY ENGINEER (SIGNATURE) | DATE

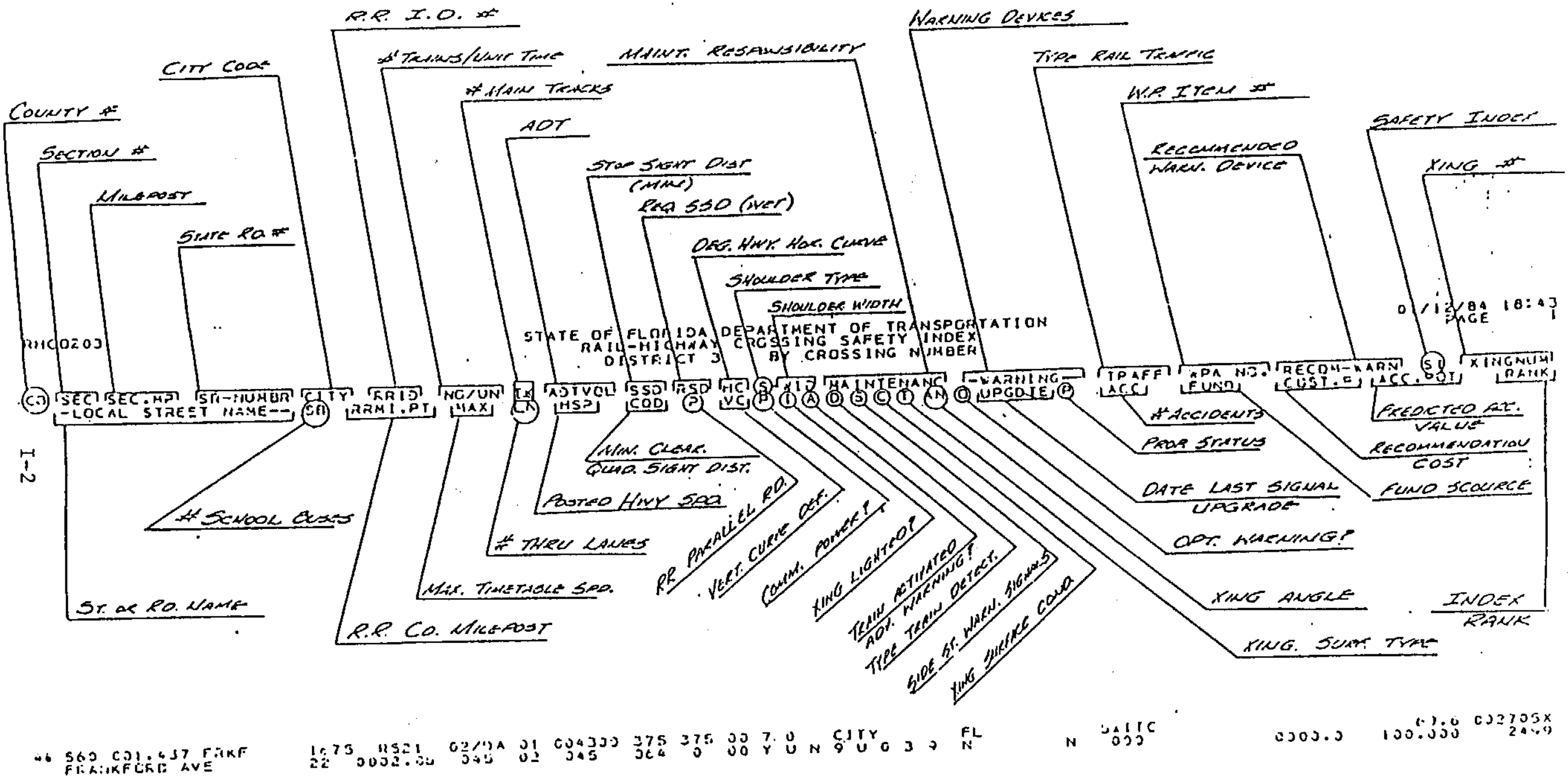
RAIL-HIGHWAY CROSSING SAFETY INDEX

ALL DISTRICTS ALL COUNTIES ALL CITIES ALL RAILROADS BY SAFETY INDEX RANK

CO SEC SEC.MP SR-NUMBR	CITY	RRID	NO/UN	TK	ADTVOL	SSD	RSD	HC	S-WID	MAINTENANC	-WARNING--	TRAFF	WPA NO.	RECOM-WARN	SI	XINGNUM
-LOCAL STREET NAME--	SB	RRMI.PT	MAX	LN	HSP	CQD	P	VC	P I A	D S C T AN	O UPGDTE P	ACC	FUND	COST.R	ACC.POT	RANK
87 000 000.000	1500	F410	20/DA	01	042324	375	375	00	7 0	STATE PRI	A CFL & G	FREIG	6113302	OVERPASS	07.5	272604E
N.E. 163RD ST.	16	0354.70	050	08	045	019	0	00	Y U Y	9 Y 3 4 9	U 110690 N	001		9999.9	000.480	0001
87 000 000.000	0645	F410	20/DA	02	034729	200	200	00	0 0	COUNTY	A&CFL&G&P	FREIG	6123074	OVERPASS	11.3	272598D
MIAMI GARDENS DR	16	0353.18	060	04	030	012	3	00	Y Y Y	9 U 3 3 9	N 110590 N	001		5000.0	000.433	0002
86 000 000.000	1780	C811	32/DA	01	048100	375	375	00	6 0	CITY	CFL & G	PASSE		OVERPASS	11.3	628168G
NW 36 ST SAMPL RD	23	1001.30	079	06	045	058	0	00	Y Y N	9 N 2 6 9	N 062882 N	003		9999.9	000.424	0003
86 110 007.851 SR0838	0645	F410	22/DA	02	055000	310	310	00	6 0	STATE PRI	ALT&FL&G&P	FREIG	4110770	OVERPASS	13.5	272549G
SUNRISE BLVD	19	0339.87	045	06	040	090	0	00	Y Y Y	9 Y 1 4 9	N 100788 N	002		9999.9	000.403	0004
87 870 000.000 SR25	0860	F411	22/DA	01	040744	310	310	00	6 0	STATE PRI	A CFL & G	FREIG		OVERPASS	14.5	272752Y
OCKEECHOBEE RD	24	0007.39	020	06	040	035	0	00	Y Y Y	9 U 2 6 8	N 010181 N	005		9999.9	000.386	0005
86 000 000.000	0645	F410	28/DA	02	032700	310	310	00	7 0	COUNTY	A&CFL&G&P	FREIG		OVERPASS	15.5	272519P
COPANS RD	20	0331.10	045	05	040	077	0	00	Y N Y	9 N 2 4 9	N 081588 N	002		9999.9	000.379	0006
86 130 004.560 SR0814	1780	C811	32/DA	02	048124	375	375	00	6 0	STATE PRI	CFL & G	PASSE	4110100	OVERPASS	16.2	628177F
ATLANTIC BLVD.	14	1004.30	079	06	045	028	0	00	Y Y N	9 N 1 6 9	N 112586 N	002		9999.9	000.379	0007
86 000 000.000	1780	C811	32/DA	03	055000	375	375	00	6 0	COUNTY	CFL & G	PASSE		OVERPASS	16.4	628186E
COMMERCIAL BLVD	12	1007.40	079	08	045	056	0	00	Y Y N	9 N 4 4 9	N 010181 N	000		9999.9	000.380	0008
86 090 005.894 SR 816	1540	C811	32/DA	01	062600	200	250	00	6 0	STATE PRI	CFL & G	PASSE	4110516	OVERPASS	17.3	628191B
OAKLAND PARK BLVD	22	1009.00	079	06	035	048	0	00	Y N N	9 N 1 6 9	N 021187 N	000		9999.9	000.357	0009
94 010 013.158 SR A1A	0665	F410	24/DA	01	018351	250	160	00	6 0	STATE PRI	A&CFL&G&P	FREIG		A&CFL&G&P	17.3	272867T
SEAWAY DRIVE	06	0240.93	065	05	025	050	0	00	Y Y Y	9 N 2 4 3	N 031488 N	003		0000.0	000.385	0010
86 015 002.796 SR 0818	0645	C811	32/DA	02	035400	200	375	00	6 0	STATE PRI	CFL & G	PASSE		OVERPASS	17.8	628272B
NEW GRIFFIN ROAD	18	1016.23	079	07	045	041	0	00	Y Y N	9 N 1 6 9	N 052386 N	002		9999.9	000.356	0011
87 000 000.000	1370	F410	20/DA	02	035150	250	250	00	7 0	COUNTY	A&CFL&G&P	FREIG		OVERPASS	18.5	272596P
N.E.203RD ST.	08	0352.86	060	06	035	148	0	00	Y U Y	9 U 0 4 9	N N	004		9999.9	000.366	0012
86 000 000.000	1780	C811	32/DA	01	045300	375	375	00	6 0	CITY	CFL & G	PASSE		OVERPASS	18.8	628169N
COPANS RD.	14	1002.31	079	06	045	068	0	00	Y Y N	9 N 2 6 9	N 020488 N	000		9999.9	000.351	0013
87 000 000.000	0860	F411	22/DA	02	025313	310	310	00	1 0	CITY	ALT FL & G	FREIG		A CFL & G	18.8	272738D
E. 4TH AVE	07	0005.55	035	04	040	040	0	00	Y Y Y	9 N 2 4 9	Y 010181 N	005		0087.0	000.366	0014
10 060 023.265 SR 0045	2075	C349	24/DA	01	037817	375	375	00	6 0	STATE PRI	CFL & G	SWITC		OVERPASS	19.0	624802A
SR-45 U.S.41	13	0882.00	015	06	045	075	3	00	Y N N	9 N 4 6 3	N 010182 N	004		9999.9	000.351	0015
77 080 006.478 SR-436	0015	C301	15/DA	01	036400	310	310	00	6 0	STATE PRI	A CFL & G	PASSE	5117528	OVERPASS	19.5	622080N
ALTAMONTE DR	31	0780.50	035	06	040	090	0	00	Y Y Y	9 Y 1 6 8	N 010182 N	004		9999.9	000.326	0016
86 210 001.994 SR 736	0477	C811	32/DA	01	033700	250	310	00	6 0	STATE PRI	CFL&G&P	PASSE	4110730	OVERPASS	20.2	628207V
DAVIE BLVD	42	1013.15	079	05	040	062	3	00	Y N N	9 N 1 6 0	N 021288 N	001		9999.9	000.312	0017

KEY SHEET

RAIL-HIGHWAY CROSSING SAFETY INDEX



10101000000000001500010112

CRASH NUMBER	DISTRICT	COUNTY	SECTION SUBSECTION	MILEPOST	NODE	DISTANCE	DIRECTION	ROAD	NUMBER	ADT	MONTH	DAY	HOUR	DAY WEEK	LANES	RURAL URBAN	TRAVEL WAY	SYSTEM	FHP ROAD SYSTEM	TYPE FAC	TYPE ROAD	HARMFUL EVENT 1	HARMFUL EVENT 2	LT COND	WEATHER	ROAD SURF	ROAD DEFECTS	TRAFFIC CONTROL	SITE LOCATION	VISION	TRF CHAR	VEH DIR 1	VEH DIR 2	PROPERTY DAMAGE	TOTAL DAMAGE	NUMBER VEHICLES	NUMBER KILLED	NUMBER INJURED
094670536	1	01	010000	013.274	01001	00.000	U	SR	45	016112	04	16	09	1	02	4	9	2	03	1	4	02	00	1	1	1	01	02	02	1	1	E	N	00	00	02	00	00
091938720	1	01	010000	013.369	01002	00.000	U	SR	45	016112	07	28	09	6	02	4	9	2	03	1	4	02	00	1	1	1	01	04	02	1	1	N	E	00	00	02	00	00
094682358	1	01	010000	013.369	01002	00.000	U	SR	45	016112	03	06	16	2	02	4	9	2	05	1	4	02	00	1	1	1	01	02	02	1	1	E	N	00	00	02	00	00
094672649	1	01	010000	013.469	01002	00.000	U	SR	45	016112	05	18	14	5	03	4	9	2	03	1	4	01	00	1	1	1	01	03	02	1	1	N	N	00	50	02	00	00
091945444	1	01	010000	013.560	01002	00.019	S	SR	45	016112	03	26	11	1	03	4	9	2	03	1	4	05	00	1	2	1	01	02	01	1	1	N	N	00	00	02	00	01
094635703	1	01	010000	013.579	01002	00.000	U	SR	45	016112	08	10	01	5	03	4	9	2	03	1	4	18	00	4	1	1	01	02	02	1	1	N		50	50	01	00	00
094671740	1	01	010000	013.579	01002	00.000	U	SR	45	016112	07	21	16	6	03	4	9	2	05	1	4	02	00	1	1	1	01	04	02	1	1	E	N	00	00	02	00	00
090359415	1	01	010000	013.766	01002	00.000	U	SR	45	016112	03	10	10	6	03	4	9	2	03	1	4	01	00	1	1	1	01	03	02	1	1	N	N	00	00	04	00	00
091938688	1	01	010000	013.766	01002	00.000	U	SR	45	016112	06	11	19	1	03	4	9	2	03	1	4	02	00	1	1	1	01	03	02	3	1	N	E	00	00	02	00	03
094670460	1	01	010000	013.766	01002	00.000	U	SR	45	016112	01	24	09	3	03	4	9	2	03	1	4	08	21	1	1	1	01	02	02	1	1	N		00	00	01	00	00
094671815	1	01	010000	013.766	01002	00.000	U	SR	45	016112	02	10	23	6	03	4	9	2	03	1	4	02	00	4	2	1	01	03	02	1	1	E	N	00	00	02	00	00
094672821	1	01	010000	013.766	01002	00.000	U	SR	45	016112	08	20	14	1	03	4	9	2	05	1	4	03	00	1	1	1	01	01	04	1	1	E	E	00	00	02	00	01
094675014	1	01	010000	013.766	01002	00.000	U	SR	45	016112	10	11	11	4	03	4	9	2	03	1	4	02	09	1	3	2	01	03	02	1	1	N	E	00	00	02	00	00
101593994	1	01	010000	013.776	01002	00.010	N	SR	45	016112	10	01	17	1	03	4	9	2	03	1	4	01	00	1	1	1	01	02	01	7	1	N	N	00	00	03	00	00
091948604	1	01	010000	013.830	01002	00.003	N	SR	45	016112	09	10	14	1	03	4	9	2	03	1	4	01	01	1	1	1	01	02	03	1	1	N	N	00	00	03	00	01
091938696	1	01	010000	013.859	01000	00.000	U	SR	45	019476	06	17	18	7	03	4	9	2	03	1	4	02	00	1	2	1	01	03	02	1	1	E	N	00	00	02	00	02
094670114	1	01	010000	013.859	01000	00.000	U	SR	45	019476	03	26	15	1	03	4	9	2	03	1	4	03	00	1	1	1	01	03	02	1	1	N	N	00	00	02	00	02
094672680	1	01	010000	013.859	01000	00.000	U	SR	45	019476	12	27	11	4	03	4	9	2	05	1	4	01	00	1	1	1	01	01	01	3	1	W	W	00	00	02	00	01
094673217	1	01	010000	013.859	01000	00.000	U	SR	45	019476	06	16	15	6	03	4	9	2	03	1	4	02	00	1	1	1	01	02	04	1	1	N	N	00	00	02	00	01
094670973	1	01	010000	013.888	01000	00.029	N	SR	45	019476	01	23	09	2	03	4	9	2	05	1	4	01	01	1	1	1	01	03	03	1	1	N	N	00	00	03	00	00
094671104	1	01	010000	013.916	01002	00.041	S	SR	45	019476	06	21	10	4	03	4	9	2	03	1	4	18	00	1	1	1	01	01	03	1	1	N		00	00	01	00	01
091945386	1	01	010000	013.957	01002	00.000	U	SR	45	019476	02	16	15	5	02	4	9	2	05	1	4	02	00	1	1	1	01	02	04	1	1	E	N	00	00	02	00	00
094674637	1	01	010000	013.957	01002	00.000	U	SR	45	019476	10	09	10	2	02	4	9	2	03	1	4	14	00	1	1	1	01	04	02	1	1	W	S	00	20	02	00	01
091945402	1	01	010000	014.097	01002	00.068	S	SR	45	019476	02	17	18	6	02	4	9	2	02	1	4	18	00	2	1	1	02	02	01	1	2	N		00	00	01	00	02
091824102	1	01	010000	014.894	01002	00.234	S	SR	45	019476	10	13	23	6	02	3	9	2	03	1	4	77	00	4	1	1	01	02	06	1	2	S	S	00	00	02	00	02

FATAL CRASH STATISTICS			INJURY CRASH STATS		PROPERTY DAMAGE CRASHES	TOTALS.		
CRASHES	FATALITIES	INJURIES	CRASHES	INJURIES	CRASHES	CRASHES	FATALITIES	INJURIES
			48	81	27	75		81

AAR0012

FLORIDA DEPARTMENT OF TRANSPORTATION
CRASH LOCATION SUMMARY
FOR THE MONTHS OF JANUARY THRU DECEMBER

DATE 07/17/91 TIME 09:24
PAGE 9

YR	DST	CO	SEC	SUB	BMP	EMP	ROAD	LENGTH	LANES	DIVID	CRASHES	ADT	ACTUAL	CRITICAL	RATIO	FTL	INJ	PRTY	ECON LOSS
90	1	1	010	000	000.000	010.000	45	10.000	4	YES	15.0	13108	.313	1.356	.230		19	4	$853400

CRASHES PER MONTH

1 JANUARY	3 FEBRUARY	1 MARCH	2 APRIL	1 MAY	JUNE
1 JULY	2 AUGUST	1 SEPTEMBER	OCTOBER	2 NOVEMBER	1 DECEMBER

NUMBER OF CRASHES PER HARMFUL EVENT

1ST	2ND	
1		COLLISION W/MV IN TRANSPORT (REAR-END)
4		COLLISION W/MV IN TRANSPORT (ANGLE)
2		COLLISION W/MV IN TRANSPORT (LEFT TURN)
		COLLISION WITH PARKED CAR
2		COLLISION W/MV IN TRANSPORT(SIDESWIPE)
		COLLISION W/MV IN TRANSPORT (BACKED INTO)
		COLLISION W/MV IN TRANSPORT (RIGHT TURN)
		MV HIT OTHER FIXED OBJECT
1		MV HIT UTILITY/LIGHT POLE
		COLLISION W/MV IN TRANSPORT (HEAD-ON)
1		COLLISION WITH PEDESTRIAN
		COLLISION WITH MOPED
		MV HIT TREE/SHRUBBERY
		COLLISION WITH BICYCLE
		COLLISION WITH BICYCLE (BIKE LANE)
1	1	MV RAN INTO DITCH/CULVERT
		RAN OFF ROAD/INTO WATER
3		OVERTURNED
		MV HIT FENCE
		COLLISION W/MV ON OTHER ROADWAY
		MV HIT SIGN/SIGN POST
		MV HIT GUARDRAIL
		COLLISION W/FIXED OBJECT ABOVE GROUND
		FIRE
		COLLISION WITH ANIMAL
	1	COLLISION W/MOVABLE OBJECT ON ROAD
		MV HIT CONCRETE BARRIER WALL
		MV HIT BRIDGE/PIER/ABUTMENT WALL
		OCCUPANT FELL FROM VEHICLE
		TRACTOR/TRAILER JACKKNIFED
		COLLISION W/CONSTRUCTION BARRIER/SIGN
		COLLISION WITH TRAFFIC GATE
		COLLISION WITH CRASH ATTENUATORS
		COLLISION WITH TRAIN
		EXPLOSION
		OTHER

CRASHES PER DAY & HOUR ("S" SIGNIFIES SCHOOL ZONE)

	MON.	TUE.	WED.	THU.	FRI.	SAT.	SUN.	TOTAL
** AM **								
12:00 12:59					1			1
1:00 1:59								
2:00 2:59								
3:00 3:59								
4:00 4:59								
5:00 5:59								
6:00 6:59							1	1
7:00 7:59				1				1
S7:00 7:59								
8:00 8:59								
S8:00 8:59								
9:00 9:59								
10:00 10:59		1						1
11:00 11:59								
** TOTAL **		1		1	1		1	4
** PM **								
12:00 12:59				1				1
1:00 1:59						1	1	2
2:00 2:59							1	1
S2:00 2:59								
3:00 3:59								
S3:00 3:59								
4:00 4:59	1							1
5:00 5:59								
6:00 6:59	1							1
7:00 7:59		1					1	2
8:00 8:59		1					1	2
9:00 9:59							1	1
10:00 10:59								
11:00 11:59								
** TOTAL **	2	2		1		1	5	11

PROPERTY DAMAGE AMOUNT

300

FOR THE MONTHS OF JANUARY THRU DECEMBER

YR	DST	CO	SEC	SUB	BMP	EMP	ROAD	LENGTH	LANES	DIVID	CRASHES	ADT	ACTUAL	CRITICAL	RATIO	FTL	INJ	PRTY	ECON LOSS
90	1	1	010	000	000.000	010.000	45	10.000	4	YES	15.0	13108	.313	1.356	.230		19	4	$853400

ROAD SURFACE CONDITION

	MV.V.MV.	MV.V.PED.	MV.V.OB.	SIN.VH	OTHER	TOTAL
DRY	9	1	1	3		14
WET			1			1
SLIPPERY						
ICY						
OTHER						

SHOULDER TYPE

1ST	2ND	3RD	
			RAISED CURB
			PAVED
15	15	15	UNKNOWN/NONE
			LAWN
			GRAVEL / MARL
			DIRT
			CURB & GUTTER
			OTHER
			CURB W RESF GUTTER

TRAFFIC CHARACTER

15	STRAIGHT - LEVEL
	STRAIGHT - UP/DOWN GRADE
	CURVE - LEVEL
	CURVE - UP/DOWN GRADE

CONTRIBUTING CAUSES - ROAD

1ST	2ND	
15	1	NO DEFECTS
		OBSTRUCTION WITH/WITHOUT WARNING
		ROAD UNDER REPAIR/CONSTRUCTION
		LOOSE SURFACE MATERIALS
		SHOULDERS-SOFT/LOW/HIGH
		HOLES/RUTS/UNSAFE PAVED EDGE
		STANDING WATER
		WORN/POLISHED ROAD SURFACE
		OTHER

CONTRIBUTING CAUSES - ENVIRONMENT

1ST	2ND	
13	1	VISION NOT OBSCURED
		INCLEMENT WEATHER
		PARKED/STOPPED VEHICLE
		TREES/CROPS/BUSHES
		LOAD ON VEHICLE
		BUILDING/FIXED OBJECT
		SIGNS/BILLBOARDS
1		FOG
		SMOKE
1		GLARE
		OTHER

SITE LOCATION

4	NOT AT INTERSECTION/RR XING/BRIDGE
10	AT INTERSECTION
	INFLUENCED BY INTERSECTION
1	DRIVEWAY ACCESS
	RAILROAD CROSSING
	BRIDGE
	ENTRANCE RAMP
	EXIT RAMP
	OTHER

TRAFFIC CONTROL

1ST	2ND	
1		NO CONTROL
12	1	SPEED ZONE CONTROL
		TRAFFIC SIGNAL
1	1	STOP SIGN
	1	YIELD SIGN
1		FLASHING LIGHT
		RAILROAD SIGNAL
		OFF./GUARD. FLAGMAN
		POSTED NO U-TURN
		OTHER

CRASHES BY LIGHTING CONDITION

	MV.V.MV.	MV.V.PED.	MV.V.OB.	SIN.VH	OTHER	TOTAL
DAYLIGHT	6			1		7
DUSK/DAWN				1		1
DARK W/ST LT	1	1	1	1		4
DARK WO/ST LT	2		1			3
UNKNOWN						

CRASHES BY WEATHER CONDITION

	MV.V.MV.	MV.V.PED.	MV.V.OB.	SIN.VH	OTHER	TOTAL
CLEAR	8	1	1	3		13
CLOUDY	1					1
RAIN						
FOG			1			1
OTHER						

CRASH LOCATION SUMMARY
FOR THE MONTHS OF JANUARY THRU DECEMBER

YR	DST	CO	SEC	SUB	BMP	EMP	ROAD	LENGTH	LANES	DIVID	CRASHES	ADT	ACTUAL	CRITICAL	RATIO	FTL	INJ	PRTY	ECON LOSS
90	1	1	010	000	000.000	010.000	45	10.000	4	YES	15.0	13108	.313	1.356	.230		19	4	$853400

POINT OF IMPACT

4	FRONT END
4	RIGHT FRONT CORNER
1	RIGHT FRT QTR PANEL
2	RIGHT FRONT DOOR
1	RIGHT REAR DOOR
	RIGHT REAR QTR PANEL
	RIGHT REAR CORNER
	REAR END
1	LEFT REAR CORNER
	LEFT REAR QTR PANEL
	LEFT REAR QTR PANEL
2	LEFT REAR DOOR
1	LEFT FRONT DOOR
1	LEFT FRT QTR PANEL
4	LEFT FRONT CORNER
	HOOD
	ROOF/OVERTURNED
	TRUNK
1	UNDERCARRIAGE
2	WINDSHIELD

CONTRIBUTING CAUSE - VEHICLE

1ST	2ND	
25		NO DEFECTS
		DEFECTIVE BRAKES
		WORN/SMOOTH TIRES
		DEFECTIVE/IMPROPER LIGHTS
		PUNCTURE/BLOWOUT
		STEERRING MECH.
		WHINDSHIELD WIPERS
1		EQUIPMENT/VEHICLE DEFECT
		OTHER

VEHICLE MOVEMENT

19	STRAIGHT AHEAD
	SLOWING/STOPPED/STALLED
3	MAKING LEFT TURN
	BACKING
1	MAKING RIGHT TURN
2	CHANGING LANES
	ENTERING/LEAVING PARKING SPACE
	PROPERLY PARKED
	IMPROPERLY PARKED
	MAKING U-TURN
	PASSING
	DRIVERLESS OR RUNAWAY VEHICLE
1	OTHER

VEHICLE FUNCTION

25	NONE
1	PULLING SEMI-TRAILER
	PULLING OTHER VEHICLE
	EMERGENCY OPERATION
	PULLING TANDEM TRAILER/DOUBLE BOTTOM
	PULLING TANK TRAILER
	PULLING HOUSE TRAILER
	PULLING SMALL TRAILER
	VEHICLE BEING TOWED/PUSHED
	PULLING POLE TRAILER
	PULLING SADDLE MOUNT
	OTHER

VEHICLE SPEED (BEFORE ACCIDENT)

	NOT STATED
	IN READY
2	0-5 MPH
4	6-10 MPH
	11-15 MPH
	16-20 MPH
4	21-30 MPH
2	31-40 MPH
3	41-50 MPH
10	51-60 MPH
	61-70 MPH
1	71-80 MPH
	81-90 MPH
	91-100 MPH
	100 + MPH
	PARKED

VEHICLES EXCEEDING POSTED SPEED BY

2	5 MPH
	10 MPH
	15 MPH
1	20 MPH
	25 MPH
	30 MPH
	35 MPH
	40 MPH
	45 MPH
	50 MPH
	55 MPH
2	OVER 57 MPH

HAZARDOUS MATERIALS

24	NONE
	FLAMMABLE LIQUID
	EXPLOSIVES
	POISONOUS GAS
	CORROSIVE MATERIALS
	RADIOACTIVE MATERIALS
2	OTHER

LOCATION ON ROADWAY

23	ON ROAD
2	NOT ON ROAD
	SHOULDER
1	MEDIAN
	TURN LANE/SAFETY ZONE

DIRECTION OF TRAVEL

	NOT STATED
10	NORTH
3	EAST
8	SOUTH
5	WEST

AAR0012	FLORIDA DEPARTMENT OF TRANSPORTATION CRASH LOCATION SUMMARY FOR THE MONTHS OF JANUARY THRU DECEMBER	DATE 07/17/91 TIME 09:24 PAGE 12

YR	DST	CO	SEC	SUB	BMP	EMP	ROAD	LENGTH	LANES	DIVID	CRASHES	ADT	ACTUAL	CRITICAL	RATIO	FTL	INJ	PRTY	ECON LOSS
90	1	1	010	000	000.000	010.000	45	10.000	4	YES	15.0	13108	.313	1.356	.230		19	4	$853400

CONTRIBUTING CAUSES DRIVER

1ST	2ND	3RD	
14			NO IMPROPER DRIVING
2			CARELESS DRIVING
6			FAILED TO YIELD RIGHT-OF-WAY
			IMPROPER BACKING
3			IMPROPER TURN
			ALCOHOL - UNDER INFLUENCE
1	1		DRUGS - UNDER INFLUENCE
			ALCOHOL & DRUGS-UNDER INFLUENCE
			FOLLOWED TOO CLOSELY
			DISREGARDED TRAFFIC SIGNAL
			EXCEEDED SAFE SPEED LIMIT
			DISREGARDED STOP SIGN
			FAILED TO MAINTAIN EQUIP/VEHICLE
			IMPROPER PASSING
			DROVE LEFT OF CENTER
			EXCEEDED STATED SPEED LIMIT
	1		OBSTRUCTING TRAFFIC
			IMPROPER LOAD
			DISREGARDED OTHER TRAFFIC CONTROL
			DRIVING WRONG SIDE/WAY
1			OTHER

RESIDENCE (DRIVER ONLY)

12	COUNTY OF CRASH
8	ELSEWHERE IN STATE
4	NON-RESIDENT STATE
2	FOREIGN
2	UNKNOWN

PHYSICAL DEFECTS

26	NO DEFECTS KNOWN
	EYESIGHT DEFECTIVE
	FATIGUE/ASLEEP
	HEARING DEFECT
	ILL
	SEIZURE, EPIL., BLKLOUT
	OTHER DEFECT

SAFETY EQUIPMENT IN USE

12	NOT IN USE
28	SEAT BELT/SHOULDER HARN
	CHILD RESTRAINT
1	SAFETY HELMET/EYE PROT
1	AIR BAG
1	OTHER

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

FORM 511-09
SAFETY
07/91

SAFETY OFFICE ANNUAL BENEFIT COST ANALYSIS

1. SUBMITTED BY ______ WPA NO. ______
2. DATE SUBMITTED ______
3. PROJECT NO. ______
4. ALTERNATIVE NO. ______

5. ______ SAFETY PRIORITY
______ ENVIRONMENTAL STUDY
SKID (I.D.) ______
SN ______ SPEED ______

6. DISTRICT ______ COUNTY ______ SECTION ______ STATE ROAD ______ U.S. ROAD ______
7. BEGINNING MILE POST ______ ENDING MILE POST ______ LENGTH ______ NODE ______
8. DESCRIPTION OF LOCATION/FACILITY TYPE ______
9. CAUSE OF CRASH PROBLEMS (LIST AND DISCUSS) ______
10. PROPOSED IMPROVEMENTS (LIST AND DISCUSS) ______

		19	19	19	AVG.
11.	NO. OF CRASHES				
12.	NO. CRASHES POTENTIALLY REDUCED BY PROPOSED PROJECT				

14. CRASH INFORMATION FOR FACILITY

COST/CRASH $______
CRASH CLEANUP $______
INTEREST RATE ______ %

13.

TYPE OF CRASH	NUMBER OF CRASHES	CRASH TO BE PREVENTED
ANGLE		
FIXED OBJECT		
JACKKNIFED OVERTURNED		
RIGHT TURN		
LEFT TURN		
REAREND		
HEADON		
SIDE SWIPE		
OTHER		
TOTAL		
WET		
SLIPPERY		

15. ANNUAL COST OF IMPROVEMENTS

TYPE	COST	LIFE	CRF	ANNUAL COST
A. R-O-W	$			$
B. P.E.C.E.I.				
C. STRUCTURE				
D. ROADWAY				
E. PAVEMENT				
F. SIGNALS				
G. SUBTOTAL				
H. CHANGE IN MAINTENANCE				
I. CRASH CLEANUP				
J. TOTAL				

16. BENEFITS

A. CRASH REDUCTION $______
B. OTHER ______
C. OTHER ______
TOTAL ANNUAL BENEFIT $______

17. BENEFIT/COST ______

PREPARED BY: APPROVED BY: DATE:

COMMENTS/CRASH REDUCTION METHOD ______

HIGH CRASH LISTINGS: ______

7% INTEREST FACTORS FOR ANNUAL COMPOUNDING INTEREST

	SINGLE PAYMENT		EQUAL PAYMENT SERIES			
YEAR	COMPOUND AMOUNT FACTOR	PRESENT WORTH FACTOR	COMPOUND AMOUNT FACTOR	SINKING FUND FACTOR	PRESENT WORTH FACTOR	CAPITAL RECOVERY FACTOR
1	1.070	0.9346	1.000	1.0000	0.9346	1.0700
2	1.145	0.8734	2.070	0.4831	1.8080	0.5531
3	1.225	0.8163	3.215	0.3111	2.6243	0.3811
4	1.311	0.7629	4.440	0.2252	3.3872	0.2952
5	1.403	0.7130	5.751	0.1739	4.1002	0.2439
6	1.501	0.6663	7.153	0.1398	4.7665	0.2098
7	1.606	0.6227	8.654	0.1156	5.3893	0.1856
8	1.718	0.5820	10.260	0.0975	5.9713	0.1675
9	1.838	0.5439	11.978	0.0835	6.5152	0.1535
10	1.967	0.5083	13.816	0.0724	7.0236	0.1424
11	2.105	0.4751	15.784	0.0634	7.4987	0.1334
12	2.252	0.4440	17.888	0.0559	7.9427	0.1259
13	2.410	0.4150	20.141	0.0497	8.3577	0.1197
14	2.579	0.3878	22.550	0.0443	8.7455	0.1143
15	2.759	0.3624	25.129	0.0398	9.1079	0.1098
16	2.952	0.3387	27.888	0.0359	9.4466	0.1059
17	3.159	0.3166	30.840	0.0324	9.7632	0.1024
18	3.380	0.2959	33.999	0.0294	10.0591	0.0994
19	3.617	0.2765	37.379	0.0268	10.3356	0.0968
20	3.870	0.2584	40.995	0.0244	10.5940	0.0944
21	4.141	0.2415	44.865	0.0223	10.8355	0.0923
22	4.430	0.2257	49.006	0.0204	11.0612	0.0904
23	4.741	0.2109	53.436	0.0187	11.2722	0.0887
24	5.072	0.1971	58.177	0.0172	11.4693	0.0872
25	5.427	0.1842	63.249	0.0158	11.6536	0.0858
26	5.807	0.1722	68.676	0.0146	11.8258	0.0846
27	6.214	0.1609	74.484	0.0134	11.9867	0.0834
28	6.649	0.1504-	80.698	0.0124	12.1371	0.0824
29	7.114	0.1406	87.347	0.0114	12.2777	0.0814
30	7.612	0.1314	94.461	0.0106	12.4090	0.0806
31	8.145	0.1228	102.073	0.0098	12.5318	0.0798
32	8.715	0.1147	110.218	0.0091	12.6466	0.0791
33	9.325	0.1072	118.933	0.0084	12.7538	0.0784
34	9.978	0.1002	128.259	0.0078	12.8540	0.0778
35	10.677	0.0937	138.237	0.0072	12.9477	0.0772
36	11.424	0.0875	148.913	0.0067	13.0352	0.0767
37	12.224	0.0818	160.337	0.0062	13.1170	0.0762
38	13.079	0.0765	172.561	0.0058	13.1935	0.0758
39	13.995	0.0715	185.640	0.0054	13.2649	0.0754
40	14.974	0.0668	199.635	0.0050	13.3317	0.0750
41	16.023	0.0624	214.610	0.0047	13.3941	0.0747
42	17.144	0.0583	230.632	0.0043	13.4524	0.0743
43	18.344	0.0545	247.776	0.0040	13.5070	0.0740
44	19.628	0.0509	266.121	0.0038	13.5579	0.0738
45	21.002	0.0476	285.749	0.0035	13.6055	0.0735
46	22.473	0.0445	306.752	0.0033	13.6500	0.0733
47	24.046	0.0416	329.224	0.0030	13.6916	0.0730
48	25.729	0.0389	353.270	0.0028	13.7305	0.0728
49	27.530	0.0363	378.999	0.0026	13.7668	0.0726
50	29.457	0.0339	406.529	0.0025	13.8007	0.0725

FORM 811-15
SAFETY
07/91

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

HAZARD ELIMINATION PROGRAM
PROJECT SUMMARY

PROGRAM YEAR ________

PROJECT DESCRIPTION

Job No.: ________ BI No.: ________ F.A. No.: ________ Dist.-Prior.: ________

County: ________ SR No.: ________ US No.: ________ Local Name: ________

Project Limits:

From: ________ MP ________

To: ________ MP ________

Crash Problem: ________

Scope of Project: ________

FISCAL DATA

Original Estimate: $ ________ Benefit/Cost Ratio: ________ Date: ________

Inflation Factor: ________ Factored Original Est.: $ ________

Actual Current Est.: $ This Yr Cost: $ ________

PROJECT HISTORY

Revisions to Scope of Project:

1. ________

Revised Estimate: $ ________ Revision Date: ________

2. ________

Revised Estimate: $ ________ Revision Date: ________

Letting Date: ________ ☐ Scheduled ☐ Actual Contract Amount: $ ________

Date Project Complete: ________

Analysis Period: Before: ________ to ________ After: ________ to ________

FLORIDA DEPARTMENT OF TRANSPORTATION
DIAGNOSTIC FIELD REVIEW REPORT
RAIL-HIGHWAY GRADE CROSSING
DATA SHEET

PROJECT NO. ____________________ W.P.A. NO. ____________________

CROSSING NO.: 624820-X PRIORITY NO.: 0118 COUNTY: HILLSBOROUGH CITY: TAMPA RDWY: FRANK ADAMO DR/SR60

CLASSIFICATION/LOCATION: DATE LAST UPDATED: 870617

R.R. CO.: CSX SYSTEMS R.R. BRANCH: AZA 340 STATION: UCETA YARD R.R. MILEPOST: 0879.90

R.R. CROSSING STATUS: OPEN AS OF 831115 PROPOSED STATUS: NO USE, OPEN

RAIL OPERATIONS: DATE LAST UPDATED: 860529

TRAIN MOVEMENTS: 10 PER DA MAXIMUM TRAIN SPEED: 020 EFFECTIVE: 831115 NO. OF MAIN TRACKS: 1 OTHER TRACKS: 00

WARNING DEVICES: DATE LAST UPDATED: 860910

EXISTING PROTECTION: CFL & G TYPE OF TRAIN DETECTION: UNKNOWN PREEMPTION: U ADVANCE WARNING: N

PHYSICAL DATA: DATE LAST UPDATED: 861003

R.R. CROSSING ANGLE: 30-39 DEGREES NO. OF THRU LANES: 04 OTHER LANES: 0 HIGHWAY SPEED: 055 DIST. TO INTERSECT.: 00000

ACTUAL STOPPING SIGHT DIST.(FT): 540 MIN. CLEAR QUAD. SIGHT DIST.(FT): 072 PARALLEL RD.: NONE OR MINOR ROAD PARALLEL

CROSSING CONDITION: POOR APPROACH CONDITION: ROUGH TRANSITION OR CROSSING MAINTAINING AGENCY: STATE PRI

DEPARTMENT DATA: DATE LAST UPDATED: 880323

TRAFFIC VOL.(ADT): 025586 AS OF 840307 SCHOOL BUS COUNT: 012 AS OF 1987 PERCENT TRUCKS: 1.00 HAZARDOUS MATLS.: U

SAFETY DATA: DATE LAST UPDATED: 880716

PRED. ACCID./YEAR: 000.154 SAFETY INDEX: 51.68 RECOMMENDED WARNING DEVICE: CFL & G ESTIMATED COST: 0000.0 THOUSAND

DESCRIPTION OF SITE/INSTALLATION CONFLICTS: ____________________

____

____________________.

REVIEW TEAM RECOMMENDATION: ____________________

____

____________________ DATE REVIEWED ____________ BY ____________.

REVIEW TEAM PERSONNEL: D.O.T. RAIL ____________ D.O.T. SAFETY ____________ RAILROAD CO. ____________

FHWA ____________ LOCAL ____________ ____________ ____________ ____________ ____________

"INSTRUCTIONS FOR USE OF DATA SHEET"

This data sheet and an 8½ X 11 attached sketch will take the place of the Diagnostic Report Form which has previously been used. The data sheet is to be used for three major purposes.

I. Diagnostic Field Report and FHWA Submittal

A. "Description of Site/Installation Conflicts" is to include any known conflicts such as culverts, utilities, and other physical obstructions that would affect the placement and/or visibility of the warning device.

B. Any erroneous information is to be noted by striking through the value and writing the correction.

II. Rail Highway Crossing Inventory Update

A. These data sheets generally will represent railroad crossings to be considered as candidate projects for safety improvements. It is very important that a correct Safety Index accurately represents the location from a legal viewpoint and as assurance that the recommendation is justifiable. These sheets may be used for the purpose of correcting RHC Data.

B. These data sheets are in no way intended to be used for the purpose of the detailed annual reinventory on the 3-year cycle. Current procedures, for this purpose remain in effect using the appropriate forms.

III. Dispensation of Priority Crossings

A. Data sheets for all crossings with a priority below a specified level will be transmitted from the Safety Office to the respective District Safety Engineer. Dispensation of data sheets for crossings, which are determined to not be considered as candidate projects, are to be returned to the Safety Office. An explanation is t be written on the sheet opposite "Review Team Recommendation," including the date and the person's name. Examples of an explanation are:

1. Programmed in 91/92 RRS for FL&G.
2. Less than 1 train movement per day.
3. City has refused to participate.
4. Recalculated to priority 2188.

If there are any questions concerning this data sheet, please contact the Safety Office at Suncom 278-3546.

PROJECT NO.

FLORIDA DEPARTMENT OF TRANSPORTATION

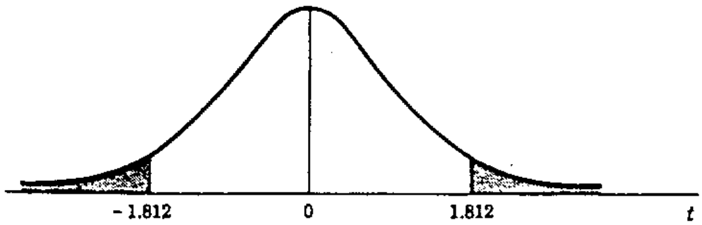
RAIL-HIGHWAY GRADE CROSSING IMPROVEMENT

CROSSING NO. ________ WPA NO. ________

LOCATION ________

DRAWING BY ________ DATE ________

Percentage Points of the t Distribution



Example

For $\phi = 10$ degrees of freedom:

$P\,[t > 1.812] = 0.05$

$P\,[t < -1.812] = 0.05$

ϕ \ α	.25	.20	.15	.10	.05	.025	.01	.005	.0005
1	1.000	1.376	1.963	3.078	6.314	12.706	31.821	63.657	636.619
2	.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	31.598
3	.765	.978	1.250	1.638	2.353	3.182	4.541	5.841	12.941
4	.741	.941	1.190	1.533	2.132	2.776	3.747	4.604	8.610
5	.727	.920	1.156	1.476	2.015	2.571	3.365	4.032	6.859
6	.718	.906	1.134	1.440	1.943	2.447	3.143	3.707	5.959
7	.711	.896	1.119	1.415	1.895	2.365	2.998	3.499	5.405
8	.706	.889	1.108	1.397	1.860	2.306	2.896	3.355	5.041
9	.703	.883	1.100	1.383	1.833	2.262	2.821	3.250	4.781
10	.700	.879	1.093	1.372	1.812	2.228	2.764	3.169	4.587
11	.697	.876	1.088	1.363	1.796	2.201	2.718	3.106	4.437
12	.695	.873	1.083	1.356	1.782	2.179	2.681	3.055	4.318
13	.694	.870	1.079	1.350	1.771	2.160	2.650	3.012	4.221
14	.692	.868	1.076	1.345	1.761	2.145	2.624	2.977	4.140
15	.691	.866	1.074	1.341	1.753	2.131	2.602	2.947	4.073
16	.690	.865	1.071	1.337	1.746	2.120	2.583	2.921	4.015
17	.689	.863	1.069	1.333	1.740	2.110	2.567	2.898	3.965
18	.688	.862	1.067	1.330	1.734	2.101	2.552	2.878	3.922
19	.688	.861	1.066	1.328	1.729	2.093	2.539	2.861	3.883
20	.687	.860	1.064	1.325	1.725	2.086	2.528	2.845	3.850
21	.686	.859	1.063	1.323	1.721	2.080	2.518	2.831	3.819
22	.686	.858	1.061	1.321	1.717	2.074	2.508	2.819	3.792
23	.685	.858	1.060	1.319	1.714	2.069	2.500	2.807	3.767
24	.685	.857	1.059	1.318	1.711	2.064	2.492	2.397	3.745
25	.684	.856	1.058	1.316	1.708	2.060	2.485	2.787	3.725
26	.684	.856	1.058	1.315	1.706	2.056	2.479	2.779	3.707
27	.684	.855	1.057	1.314	1.703	2.052	2.473	2.771	3.690
28	.683	.855	1.056	1.313	1.701	2.048	2.467	2.763	3.674
29	.683	.854	1.055	1.311	1.699	2.045	2.462	2.756	3.659
30	.683	.854	1.055	1.310	1.697	2.042	2.457	2.750	3.646
40	.681	.851	1.050	1.303	1.684	2.021	2.423	2.704	3.551
60	.679	.848	1.046	1.296	1.671	2.000	2.390	2.660	3.460
120	.677	.845	1.041	1.289	1.658	1.980	2.358	2.617	3.373
∞	.674	.842	1.036	1.282	1.645	1.960	2.326	2.576	3.291

SOURCE: This table is abridged from Table III of Fisher & Yates: *Statistical Tables for Biological, Agricultural and Medical Research* published by Oliver & Boyd Ltd., Edinburgh

NUMBER YEARS/ PROJECT	TOTAL CRASHES X_1	DIFFERENCE FROM AVERAGE $(X - V)$	$(X_1 - V)^2$
1	22	-3.34	11.16
2	33	7.66	58.68
3	32	6.66	44.36
4	20	5.34	28.52
5	16	-9.34	87.24
6	29	3.66	13.40
$ng = 6$	$\Sigma X_1 = 152$	$V = \frac{\Sigma X_1}{ng} = 25.34$	$\Sigma(X_1 - V)^2 = 243.36$

Standard deviation = σ

$$\sigma = \sqrt{\frac{\Sigma\,(X_1 - V)^2}{ng-1}} \qquad = \sqrt{\frac{243.36}{(6-1)}} \qquad = 6.98$$

Approved:

Effective:
Responsible Office: Federal Aid Office
Topic No.: 500-000-200-a

CERTIFICATION ACCEPTANCE - HIGHWAY SAFETY PROJECTS

PURPOSE:

To set forth the laws, regulations, directives and standards to be used by the Florida Department of Transportation for administering federal funded Hazard Elimination (HES) Program projects under certification acceptance.

AUTHORITY:

Federal:

(1) Federal Highway Administration, Federal-Aid Program Manual, Volume 6, Chapter 5, Section 2 and Volume 8, Chapter 2, Section 3.

(2) 23 U.S.C. 101(e), 105 (f), 117, 152, 315 and 49 CFR 1.48(b).

STATE:

Florida Statutes 334.044(10)(b), 344.044(23), 339.05, 339.06 and 339.07.

GENERAL:

(1) Certification acceptance will apply to selection, design and construction of HES funded Highway Safety Improvement projects (23 USC 152).

(2) Projects will be located on any public road excluding the Interstate system. All contracts will be let and administered by the Florida Department of Transportation.

(3) The FDOT Highway Safety Improvement Program Manual approved by FHWA on September 30, 1982 contains procedures for selecting, planning, developing, implementing and evaluating HES funded projects in compliance with FHPM 8.2.3.

(4) The Florida Department of Transportation Secretary will insure that state laws, regulations, directives and standards, either separately or collectively are enforced towards accomplishing the following Title 23 policies and objectives:

(a) Public involvement in the development of safety projects in the location and design stages as described in the FDOT manual titled "Project Development and Environmental Guidelines".

(b) Application of appropriate design and construction standards as described in the following FDOT manuals:

1. Manual on Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways and appropriate AASHTO Standards as referenced in 23 CFR 625.

2. Plans Preparation Manual.

3. FHWA "Manual on Uniform Traffic Control Devices".

4. Drainage Manual.

5. Flexible Pavement Manual.

6. Roadway and Traffic Design Standards.

7. Design Standards for Resurfacing, Restoration and Rehabilitation (RRR) of Streets and Highways.

(c) Emphasis on improving safety in location, design and construction of HES projects is incorporated in the FDOT Highway Safety Improvement Program Manual, Design Standards and Construction Specifications described above.

(d) Controls to assure quality and economy of construction and maintenance as described in the following FDOT manuals and provisions:

1. Construction Manual.

2. Standard Specifications for Road and Bridge Construction.

   a. Supplemental Specifications.

   b. Special Provisions.

3. Sampling, Testing and Reporting Guide.

4. Maintenance Condition Standards.

(e) Provision of adequate signing, marking and traffic control devices as described in FDOT Administrative Rule 14-15.10 titled "Manual on Uniform Traffic Control Devices" and Florida Statutes 316.0745 paragraph 1.

(f) Minimizing adverse economic, social and environmental impacts of a safety project as described in the FDOT manual titled "Project Development and Environmental Guidelines".

(g) Equal employment opportunity, nondiscrimination on the basis of race, age or sex, and highway construction training as described in the following supplemental specifications, special provisions or attachments to the specification package:

1. Affirmative Action Requirements - notice of requirement for affirmative action to ensure equal employment opportunity (Executive Order 11246).

2. Disadvantaged Business Enterprises - participation by minority business enterprises in FDOT programs.

3. Specific equal employment opportunity responsibilities (FHPM 6-4-1-2).

4. Required Contract Provision - Federal Aid Construction Contracts.

5. Federal Aid Proposal Notices - notices to prospective Federal Aid Construction Contractors (Attachment 2, FHPM 6-4-1-1).

6. DBE percentage goals.

7. Special Provisions - DBE.

8. Training Special Provisions (on-the-job-training).

(h) Competitive bidding as described in the FDOT "Standard Specifications for Road and Bridge Construction", Florida Statutes 287 and 337, and Chapter 14-22 of the rules of the FDOT.

(i) Payment of prevailing wage rates on construction contracts as described in the FDOT supplemental specifications titled "Federal Wage Rate Tables".

(j) Preservation of natural beauty as described in the FDOT manual titled "Project Development and Environmental Guidelines" and implemented through the FDOT's "Standard Specifications for Road and Bridge Construction".

PROCEDURE:

(1) Established procedures for system revisions, program actions, environmental processing and records retention will not be affected by this certification.

(2) The following duties and responsibilities will be performed by the FDOT:

(a) Districts:

1. Select, design, construct and administer highway safety projects.

2. Provide information to assist the Safety Office in project evaluations and preparation of the FHWA Highway Safety Improvement Program Annual Report.

(b) Safety Office:

1. Establish and update policies and procedures pertaining to the Highway Safety Improvement Program.

2. Prepare and submit the annual Highway Safety Improvement Program Report to FHWA.

3. Perform project evaluations.

4. Conduct District Quality Assessment Reviews.

(c) Federal Aid Office:

1. Prepare and submit the annual 105 Program and modifications to FHWA.

2. Request project authorizations from FHWA.

3. Submit project agreements (PR-2) and modifications (PR-2A) to FHWA.

(3) If the District Secretary finds that exceptions to CA procedures or standards are appropriate on a safety project, such exceptions shall be promptly brought to the attention of the FHWA for consideration.

(4) A project agreement shall be executed as soon as practicable after authorization on FHWA form PR-2 (Federal Aid Project Agreement), based on the best available cost estimate. Agreement amounts shall be modified promptly on FHWA form PR-2A (Modification of Federal Aid Project Agreement) upon the award of a contract for construction or when any other project action substantially changes total costs.

(5) Reports requested by FHWA listed in the attachment to FHPM 6-5-2 will continue to be furnished by the FDOT.

(6) The District Secretary will notify FHWA when a safety project is complete and/or ready for an FHWA inspection.

(7) Final vouchers shall be submitted to the FHWA in which the District Secretary certifies that the plans, design and construction of the safety project were in accordance with the laws, regulations, directives and standards of the State of Florida and/or the Florida Department of Transportation or such safety project exceptions as were previously approved by the FHWA.

(8) Revisions or amendments to the State certification will be approved and signed by the Secretary of the Florida Department of Transportation and submitted to the FHWA Division Administrator. The existing state certification will be reviewed periodically to determine its adequacy in light of FHPM 6.5.2, the laws, regulations, directives and standards in effect at the time of the review and the operational reviews made by FHWA.

SUBMITTED FOR APPROVAL:

Kaye N. Henderson 9/6/88

KAYE N. HENDERSON DATE
SECRETARY OF TRANSPORTATION

APPROVED BY FEDERAL HIGHWAY ADMINISTRATION

SEP 12 1988

LEON N. LARSON DATE
REGIONAL ADMINISTRATOR

FLORIDA DEPARTMENT OF TRANSPORTATION
605 Suwannee Street, Tallahassee, Florida 32399-0450, Telephone (904) 488-8541
BOB MARTINEZ
GOVERNOR
KAYE N. HENDERSON
SECRETARY

March 10, 1989

M E M O R A N D U M

TO: District Secretaries

FROM: Ben Watts, Assistant Secretary Ben Watts

COPIES TO: Messrs. J. R. Skinner, V. G. Marcoux, Allen Potter, District Directors of Production, District Safety Office, District P.D.&E. Office, District Right-of-Way Office, District Utility Office, District Design Office, District Construction Office, Central Safety Office, Central Design Office, Central Construction Office, Ray Reissener and Charles T. Faircloth.

SUBJECT: PROCESSING OF HES PROJECTS UNDER CERTIFICATION ACCEPTANCE

Certification Acceptance (CA) Procedures indicate the districts duties and responsibilities are to select, design, construct, and administer Federal Aid highway safety projects. However, certain activities still require direct FHWA involvement. On September 15, 1988 and again on November 8, 1988, FDOT received correspondence from FHWA outlining these activities. (See Attachments 1 and 2).

As stated in these documents direct FHWA involvement is still required in the processing of environmental documents and Authorization to proceed with Preliminary Engineering, Right-of-Way, and Construction. Any item not requiring direct FHWA involvement is considered to be the responsibility of the State and under CA Procedures, FDOT is certifying that all activities will be accomplished.

If the Department desires to avail itself of the benefit of federal funds we must submit a program or programs of proposed projects for the utilization of the federal funds apportioned to us. This program of proposed projects is called the Annual 105 Plan and is submitted to FHWA by the Assistant Secretary via the Federal-Aid Office in September of each year.

The Annual 105 Plan is a program that extracts information on federal projects only from the Work Program Administration (WPA) file and is for the Federal Fiscal Year (October through September). Through the 5-Year Transportation Plan process projects are included in the Annual 105 Plan. This plan is a monthly or quarterly plan and is by district, item number, phase, fund and work mix. This plan reflects the month that a phase of a project is scheduled to be authorized by FHWA. As you can see, it is critical that each phase be scheduled in MPSS.

When FHWA approves the plan each central and district office involved in developing and processing federal-aid projects is advised.

After approval of projects as part of the Annual 105 program, the flow for requests for Authorization will be as follows:

1. The Districts will process the Environmental documents in the normal manner.
2. Authorization to proceed with Preliminary Engineering, Right-of-Way, and Construction will proceed in the normal manner. If a consultant is to be used, and if federal funds are to be used to fund the proposed consultant contract, FHWA must approve the consultant selection and agreement provision.

3. A modified P.S.& E. will be submitted to FHWA by the Federal Aid office for Construction Authorization. This Modified P.S.& E. will consist of:

   A) Environmental Approval.
   B) Right-of-Way Certification.
   C) Utility Certification.
   D) Maintenance Agreement (If Needed).

It should be noted that established procedures of system revisions, program actions, environmental processing, Right-of-Way Acquisition and records retention will not be affected by this certification. In accordance with 23 CFR 17.5 records will be retained for a minimum of 3 years or until all litigations, claims or audit findings initiated before the expiration of the 3-year period have been resolved.

The 3-year retention periods start when the final voucher is submitted.

The following procedures present the responsibility of each area involved in the Certification Acceptance process:

DISTRICT RESPONSIBILITY

DISTRICT SAFETY OFFICE

1. Each District Safety Engineer will obtain conceptual approval of projects for inclusion in the HES Safety Program from the District Secretary (or his designee). Suggested memorandum attached. (Attachment 4).

2. Each District Safety Engineer will transmit files to the District Production Office by FDOT County-Section-Job Number pertaining to the following:

A. Public involvement in the initial development of a safety project.
B. The conceptual engineering report which will include items described in Chapter 2.1.5 of the FDOT Highway Safety Improvement Program Manual plus the approval memorandum.
C. Correspondence pertaining to the District Safety Engineer's plans review to ensure that design is within the original scope.

DISTRICT P.D.& E. ENGINEER

1. Perform environmental processing in the normal manner, with approved copies to District Production Office and the Federal Aid Office.

DISTRICT RIGHT-OF-WAY OFFICE

1. Process Right-of-Way Package in the normal manner.

2. Submit Right-of-Way Certification to District Production Office and Federal-Aid Office.

DISTRICT DESIGN OFFICE

1. Maintains design project file.

2. Certifies to District Production Office project is ready to be let to construction.

NOTE: 30, 60 and 90% Plan Review by FHWA is not required for CA projects.

DISTRICT UTILITY OFFICE

1. Submit Utility Certification to the District Production Office and Federal-Aid Office.

DISTRICT DIRECTOR OF PRODUCTION (OR HIS DESIGNEE)

1. Maintains project files which must contain, as a minimum, the following items:

   A) Conceptual Engineering Report and memorandum of Approval.
   B) Environmental Determination (Reevaluation).
   C) Right-of-Way Certification.
   D) Utility Certification.
   E) Maintenance Agreement (if needed).

2. When a project is ready for the construction phase, prepare memorandum (Attachment 3) and forward to the Federal-Aid Office no later than the "To Federal-Aid" date on the <u>CRITICAL DATES LIST</u>.

3. Submit plans to Tallahassee through normal process.

DISTRICT CONSTRUCTION OFFICE

1. Maintains project files and records in the normal manner.

2. Sends Notice of Beginning of Construction and Notice of Completion of Construction to District Production Office in addition to the offices copied currently.

3. Certifies that the project is complete.

<u>CENTRAL OFFICE RESPONSIBILITY</u>

STATE SAFETY OFFICE

1. The State Safety Office will maintain current policies and procedures pertaining to the Highway Safety Improvement Program. This office will also maintain files pertaining to:

   A) Submittal of the Annual Highway Safety Improvement Program Report to FHWA.
   B) Project Evaluations.
   C) District quality assessment reviews which will include:
      1) Project Identification.
      2) Project Selection and Justification.
      3) Production.
      4) Construction.
      5) Operations.

2. The State Safety Office will not maintain any files related to specific HES projects.

CENTRAL OFFICE DESIGN

1. Process projects in the normal manner.

CENTRAL OFFICE CONSTRUCTION

1. Process projects in the normal manner.

FEDERAL-AID OFFICE

1. Assures project is in the 105 program.

2. Process Modified P.S.& E to FHWA for authorization.

3. Submit all other Request for Authorization to FHWA.

4. Distribute FHWA's Letter of Authorization (PR-1240) to all concerned parties.

5. Process Project Agreements and Modifications of Project Agreements to FHWA.

FLORIDA DEPARTMENT OF TRANSPORTATION
ALTERNATE RAIL-HIGHWAY GRADE CROSSING PROCEDURE

I. GENERAL

Section 130 of Title 23, U.S.C., provides for a program to eliminate hazards at railroad-highway crossings with the provision that there be a crossing inventory and schedule of projects for this purpose, regulatory signs placed at all crossings, specific Federal-aid funds that can be used for crossing improvements on any public road, and an annual report on the progress of the program and effectiveness of the improvements.

The objective of this submittal is to define an alternate procedure as described in paragraph 11 of FHPM 6-6-2-1, for the Florida Department of Transportation to manage the following types of grade crossing improvements:

- Installation of standard signs and pavement markings.
- Installation or replacement of active warning devices.
- Upgrading of active warning devices, including track circuit improvements and interconnection with highway traffic signals.
- Crossing illumination.
- Crossing surface improvements.
- General site improvements.

II. PROCESSING GUIDELINES AND PROCEDURES

In accordance with FHPM, Vol. 8, Chapter 2, Section 3, and Paragraph 11 of FHPM 6-6-2-1, the Florida Department of Transportation has established that it is in the best interest of the State of Florida to initiate the following procedures in the management of all railroad-highway grade crossing projects funded under Section 130(f) of Title 23, U.S.C., except the following types of work which are to be reviewed and approved in the normal manner:

- All Federal-aid Interstate work.
- Reconstruction of existing or new grade separations.
- Relocation of highways.
- Relocation of railroads.
- Crossing closure without other construction.
- Adjustment to railroad facilities required by highway construction.
- Adjustments to facilities that are jointly owned or used by railroad and utility or communication companies required by highway construction.

A. Highway Safety Improvement Program Manual (HSIPM) and Rail Office Procedure Manual.

The Department's Rail Office Procedures, Volume III, and HSIPM are in compliance with the laws and regulations outlined in Paragraph 11d of FHPM 6-6-2-1. The HSIPM procedures have been approved by FHWA as being in compliance with FHPM 8-2-3.

B. 105 Program.

The Federal-aid Office submits the Rail-Highway Grade Crossing Program as part of the annual 105 Program and any revisions thereto.

C. Project Concepts/Authorizations.

The following is the Rail Office Procedure No. 725-080-070 which the Florida Department of Transportation will follow when processing rail-highway grade crossing safety improvements under the alternate procedure (see attached flow chart).

Under these provisions, each FDOT District Secretary will act in the relative position of FHWA for approval of agreements which include the plans, specifications and estimates.

1. Safety Index/Priorities.

Priority crossings will be identified annually (based on accident potential) as described in the FDOT HSIPM, Section 1.4.7. Other programs funded with 23 U.S.C. 130(f) funds may include corridor improvements and other special programs (i.e., circuitry improvements, lens upgrading, etc.) as needed and as approved by FHWA.

2. Generic Estimate.

Railroad companies have the option of developing and submitting annual generic estimates for the various types of protective devices to the Rail Office for approval. The Rail Office will, at least annually, request the railroad companies to prepare a preliminary engineer's estimate of improvement costs using the "generic" format.

3. Diagnostic Review.

An on-site inspection of each of the candidate crossings will be made and a diagnostic team will select appropriate warning systems and other safety improvements as described in the Department's HSIPM, Section 2.3.

4. Conceptual Program/Candidate Crossings.

The Department's proposed Statewide Annual Rail-Highway Grade Crossing Safety Improvement Program describing the proposed work to install or upgrade protective devices at the candidate crossings will be compiled bý the State Safety Office and submitted to FHWA for conceptual approval. The submittal will include the Diagnostic Field Review Report, a cost estimate sheet, and a plan sheet of existing conditions and proposed improvements.

5. Federal-Aid Authorizations.

Federal-aid authorization will be requested for preliminary engineering and construction for not more than two Federal-aid projects per district using RRP and RRS funds. The approved list of crossing improvements, along with the estimated cost, will be included with the submittals for authorization.

After Federal-aid authorization, the Federal-aid Office will submit Project Agreements (PR-2) to FHWA for each project. Deletions or additions to these lists will be handled with a PR-2A, prepared by the Department's Federal-aid Office and forwarded to FHWA for concurrence.

D. Force Account Procedure.

After authorization, force account agreement packages are approved for FHWA by the Department and distributed to the railroad companies with notification to proceed with the work.

The general guide for processing force account agreements under this alternate procedure will be the process outlined in the Rail Office's Procedure Number 725-080-120, Crossing Agreements, and Number 725-080-125, Signal Agreements, with exception of submittals to the Division Administrator of FHWA.

1. Agreements.

The following portions of the Rail Office procedures are modified for operation under the alternate procedure:

a. Railroad Operations - Agreements (725-080-120) Grade Crossing.

(1) Amend Paragraph 3.D to read:

When Federal-aid funds are participating in the cost of railroad work, the District Secretary will act for the Division Administrator of the Federal Highway Administration. The agreement will be approved by the Department for FHWA after issuance of the letter of authorization (PR-1240).

(2) Delete Paragraph 3.F, handle distribution of agreement as prescribed in Paragraph 3.E.

b. Railroad Operations - Agreements (725-080-125) Signals.

Follow same procedure as Number 725-080-120 above.

c. When approved by FHWA, lump sum agreements may be used for the Rail-Highway Grade Crossing Safety Program and will follow Rail Office Procedure No. 725-080-135 with exception of individual submittals to FHWA.

d. Section 725-080-035, Reimbursable (Federal-Aid Projects), is hereby amended under the alternate procedure to read:

(1) Preliminary requirements - Preliminary engineering incurred after the Federal Highway Administration's authorization will be eligible for Federal-aid reimbursement, but no costs of actually performing adjustments, removals or installations will be eligible for Federal-aid reimbursement until after the approval date of the railroad agreement by the Department. The district railroad section then gives the railroad company notification to proceed with the physical installation.

(2) Paragraph 2, "Department Reimbursement Policy," applies as stated to both the "normal" procedure of operation and the alternate procedure.

e. Railroad Use of Consultants and Contractors.

(1) The established uniform procedure for contract advertising and award by the railroad agency for preliminary engineering, construction work and/or materials to accomplish the installation and or relocation of railroad facilities is hereby amended under the alternate procedure. Approval of consultant contracts for preliminary engineering and of construction contracts may be given for the Rail-Highway Grade Crossing Safety Program and will follow Rail Office Procedure Numbers 725-080-115 and 725-080-180 with the exception of approval of the contracts by FHWA.

(2) Railroad Operations - Agreements (725-080-180) Contract Advertising and Award by Railroads.

(a) Amend Paragraph 6 to read:

If Federal-aid participating, the District Railroad Coordinator will review and approve the railroad's proposal and will notify the railroad of the Department's authorization to proceed with the railroad contract.

(b) Delete Paragraph 7.

f. Where any Department project involving railroad force account work with Federal-aid funds exceeds $250,000, the Department will follow in the required manner FHPM 6-4-1-14 and FHWA Division Office policy letter of June 28, 1984.

2. Billing Procedures.

The Department will follow its normal procedures: No. 725-080-225, Reimbursement; No. 725-080-230, Billings; No. 725-080-235, Review and Processing; Appendix No. 89-73, Auditing for Rail Highway Grade Crossing Construction Work; and Appendix No. 89-90, Reimbursement for Railroad Work.

E. Construction Contract Procedures.

1. Title 23 Policies and Objectives.

The Florida Department of Transportation will insure that state laws, regulations, directives and standards involved with awarding construction work using RRP/RRS funds to a highway contractor will either separately or collectively be enforced towards accomplishing the following Title 23 policies and objectives:

a. Public involvement in the development of Rail-Highway Grade Crossing Safety Program projects in the location and design stages as described in the FDOT manual titled "Project Development and Environmental Guidelines".

b. Application of appropriate design and construction standards as described in the following FDOT manuals:

(1) Manual on Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways and appropriate AASHTO Standards as referenced in 23 CFR 625.

(2) Plans Preparation Manual.

(3) FHWA "Manual on Uniform Traffic Control Devices".

(4) Drainage Manual.

(5) Flexible Pavement Manual.

(6) Roadway and Traffic Design Standards.

(7) Design Standards for Resurfacing, Restoration and Rehabilitation (RRR) of Streets and Highways.

c. Emphasis on improving safety in location, design and construction of railroad grade crossing projects is incorporated in the FDOT Highway Safety Improvement Program Manual, Design Standards and Construction Specifications described above.

d. Controls to assure quality and economy of construction and maintenance as described in the following FDOT manuals and provisions:

(1) Construction Manual.

(2) Standard Specifications for Road and Bridge Construction.

(a) Supplemental Specifications.

(b) Special Provisions.

(3) Sampling, Testing and Reporting Guide.

(4) Maintenance Condition Standards.

e. Provision of adequate signing, marking and traffic control devices as described in FDOT Administrative Rule 14-15.10 titled "Manual on Uniform Traffic Control Devices" and Florida Statutes 316.0745, paragraph 1.

f. Minimizing adverse economic, social and environmental impacts of a Rail-Highway Grade Crossing Safety Program project as described in the FDOT manual titled "Project Development and Environmental Guidelines" (see also Section III of these alternate procedures).

g. Equal employment opportunity, nondiscrimination on the basis of race, age or sex, and highway construction training as described in the following supplemental specifications, special provisions or attachments to the specification package:

(1) Affirmative action requirements - notice of requirement for affirmative action to ensure equal employment opportunity (Executive Order 11246).

(2) Disadvantaged Business Enterprises - participation by minority business enterprises in FDOT programs.

(3) Specific equal employment opportunity responsibilities (FHPM 6-4-1-2).

(4) Required Contract Provision - Federal-Aid Construction Contracts.

(5) Federal-Aid Proposal Notices - notices to prospective Federal-Aid Construction Contractors (Attachment 2, FHPM 6-4-1-1).

(6) DBE percentage goals.

(7) Special Provisions - DBE.

(8) Training Special Provisions (on-the-job-training).

h. Competitive bidding as described in the FDOT "Standard Specifications for Road and Bridge Construction", Florida Statutes 287 and 337, and Chapter 14-22 of the rules of the FDOT.

i. Payment of prevailing wage rates on construction contracts as described in the FDOT supplemental specifications titled "Federal Wage Rate Tables".

j. Preservation of natural beauty as described in the FDOT manual titled "Project Development and Environmental Guidelines" and implemented through the FDOT's "Standard Specifications for Road and Bridge Construction".

2. The Department will utilize the timesaving procedures, such as abbreviated plans and grouping of projects, allowed by FHWA directives.

F. Notice of Work Completion.

Upon completion of signal installation with all advance signs and pavement markings in place, a final inspection will be performed by Department personnel and documented on Form No. 521-16, "Notice of Reimbursable Utility Construction Work."

DISTRIBUTION

Copy 1: District Construction Engineer
Copy 2: Resident/Project Engineer
Copy 3: Federal Highway Administration
Copy 4: Federal-Aid Programs Manager
Copy 5: Rail Office
Copy 6: Office of Safety
Copy 7: District Director of Planning and Programs
Copy 8: District Railroad Coordinator

G. FHWA Final Inspection/Acceptance.

The Federal Highway Administration will final inspect the work at each crossing or review a random number of crossings within each project and issue a final inspection report (either by crossing, group of crossings, or entire project). A final acceptance report (Form FHWA 1446B) for each Federal-aid project will be issued by FHWA when all work under the project has been completed.

H. Evaluations.

The Department's Safety Office will evaluate the effectiveness of the installations in accordance with the requirements of the Department's Highway Safety Improvement Program Manual.

I. Quality Assessment Reviews by Safety Office and Rail Office.

The Rail Office will conduct quality assessment reviews of contracts and administrative functions in each district.

The Safety Office will conduct quality assessment reviews in each district pertaining to:

1. District review of priority crossings.

2. Project selection and justification.

3. Production.

4. Construction.

III. ENVIRONMENTAL PROCESSING

23CFR771.117(c) lists "railroad warning devices" as a type of project that can be environmentally processed as a categorical exclusion without any further documentation. Additional project types were approved by FHWA on February 25, 1988 as being "programmatic categorical exclusions" requiring no additional documentation (i.e., same status as those under 23CFR771.117(c)), assuming no additional right-of-way is needed. Among these project types are: upgrade railroad track circuitry, improve railroad crossing surface, improve vertical and horizontal alignment of railroad crossing and improve sight distance at railroad crossing. Crossing improvements of the above types will be so noted with the request for FHWA authorization. For other crossing improvements, individual environmental processing will be handled in accordance with the FDOT's Project Development and Environmental Guidelines.

IV. STANDARDS AND SPECIFICATIONS

The types of grade crossing improvements applicable under this alternate procedure identified in Paragraph I, will be constructed in accordance with the Florida Department of Transportation Standard Indexes, in particular, 17882, 560, 700, the Department's Standard Specifications, and the Manual on Uniform Traffic Control Devices.

V. EXCEPTIONS

If the District Secretary finds that exceptions to these alternate procedures or standards are appropriate on a rail-highway grade crossing project, such exceptions shall be promptly brought to the attention of the FHWA for consideration.

SUBMITTED FOR APPROVAL:

Kaye N Henderson, P.E.

KAYE N. HENDERSON — DATE 10-27-88

SECRETARY OF TRANSPORTATION

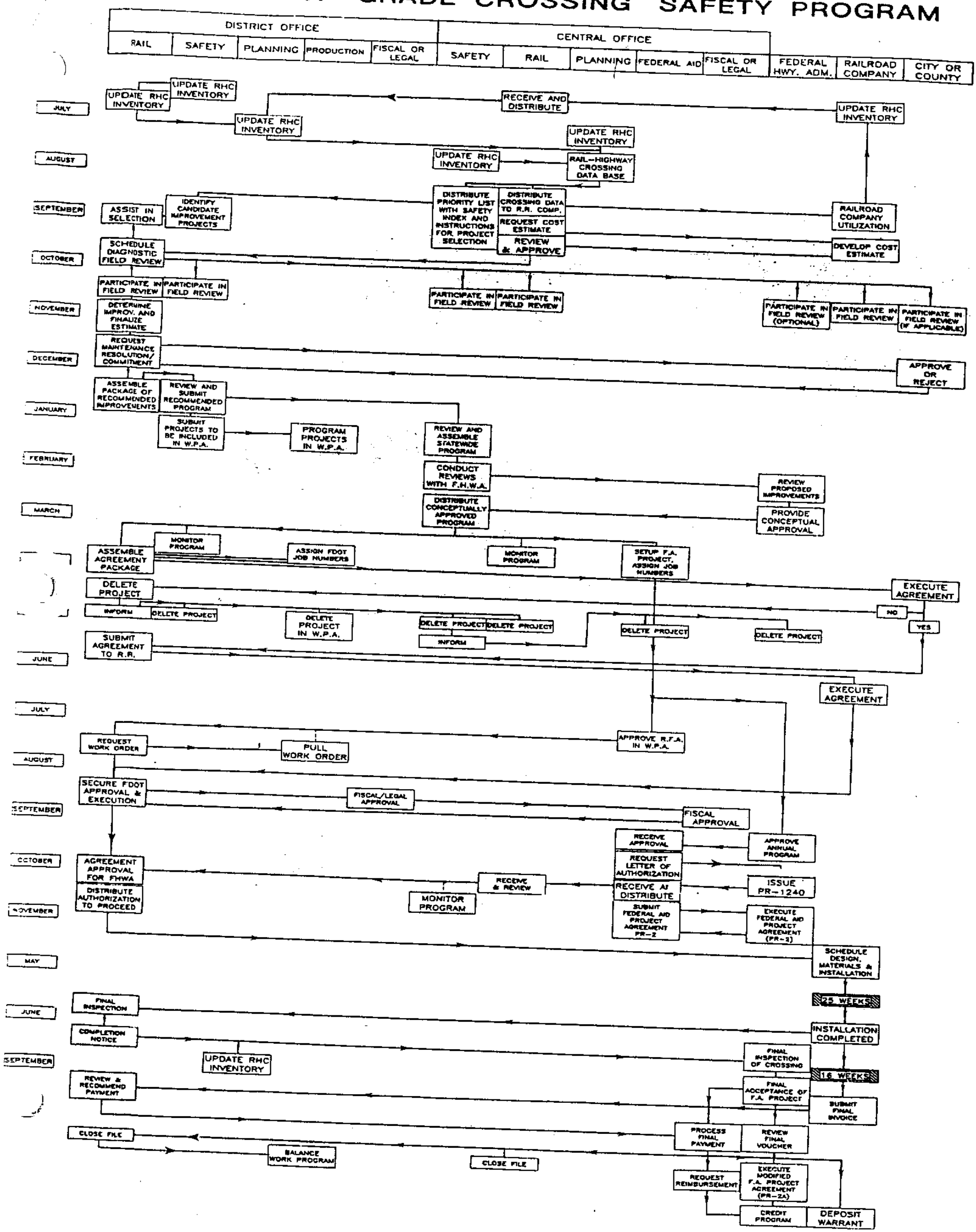
APPROVED BY FEDERAL HIGHWAY ADMINISTRATION

Gary Hamby — NOV 17 1988

Gary Hamby — DATE

Director, Office of Engineering and Operations

RAIL-HIGHWAY GRADE CROSSING SAFETY PROGRAM



USE OF SLIPPERY WHEN WET SIGNS

Conditions for Use

The District Traffic Operations Engineer shall request the District Maintenance Engineer to erect SLIPPERY WHEN WET signs at locations where the posted highway speed is above 45 miles per hour, friction numbers are less than 30, and one of the following conditions is also met:

- Location is on the High Accident Section or High Accident Spot computer listings.
- Any downgrade greater than 3 percent.
- At intersections with traffic signals.

Location and Placement

Additional signs may be needed at locations with the following conditions:

Horizontal Curves. SLIPPERY WHEN WET signs are to be placed prior to the CURVE Sign with an advisory speed plate. The ball-bank indicator provides a reasonable speed through the curve; however, a lower speed may be desired if there are known extraordinary hazards such as hydroplaning.

Hydroplaning. Generally, hydroplaning only occurs at speeds above 47 MPH; however, excessive runoff across travel lanes may produce hydroplaning at lower speeds. Multilane facilities, rutted lanes, built-up shoulders and downgrades are candidate locations. If excessive water build-up cannot be corrected, then SLIPPERY WHEN WET signs may be appropriate even when friction numbers are greater than 30.

New 6/15/91

Ramp and Bridge Decks. Interchange exit or entrance ramps on sharp curves and on a downgrade may present a hazardous condition if the pavement is also slippery. Special attention should be given to ramps with compound curves. A pavement friction inventory is normally maintained for interchange ramps; however, special tests, at speeds less than 40 miles per hour can be requested. SLIPPERY WHEN WET signs should be used with an advisory exit speed sign, W13-2, "Ramp XX MPH." Steel bridge decks can also be a problem and should be signed prior to the decking.

Notification

The District Maintenance Engineers will promptly notify in writing the District Traffic Operations Engineer when SLIPPERY WHEN WET signs have been erected.

The District Traffic Operations Engineer shall request the District Maintenance Engineer to remove SLIPPERY WHEN WET signs that are no longer warranted under the above provisions.

New 6/15/91